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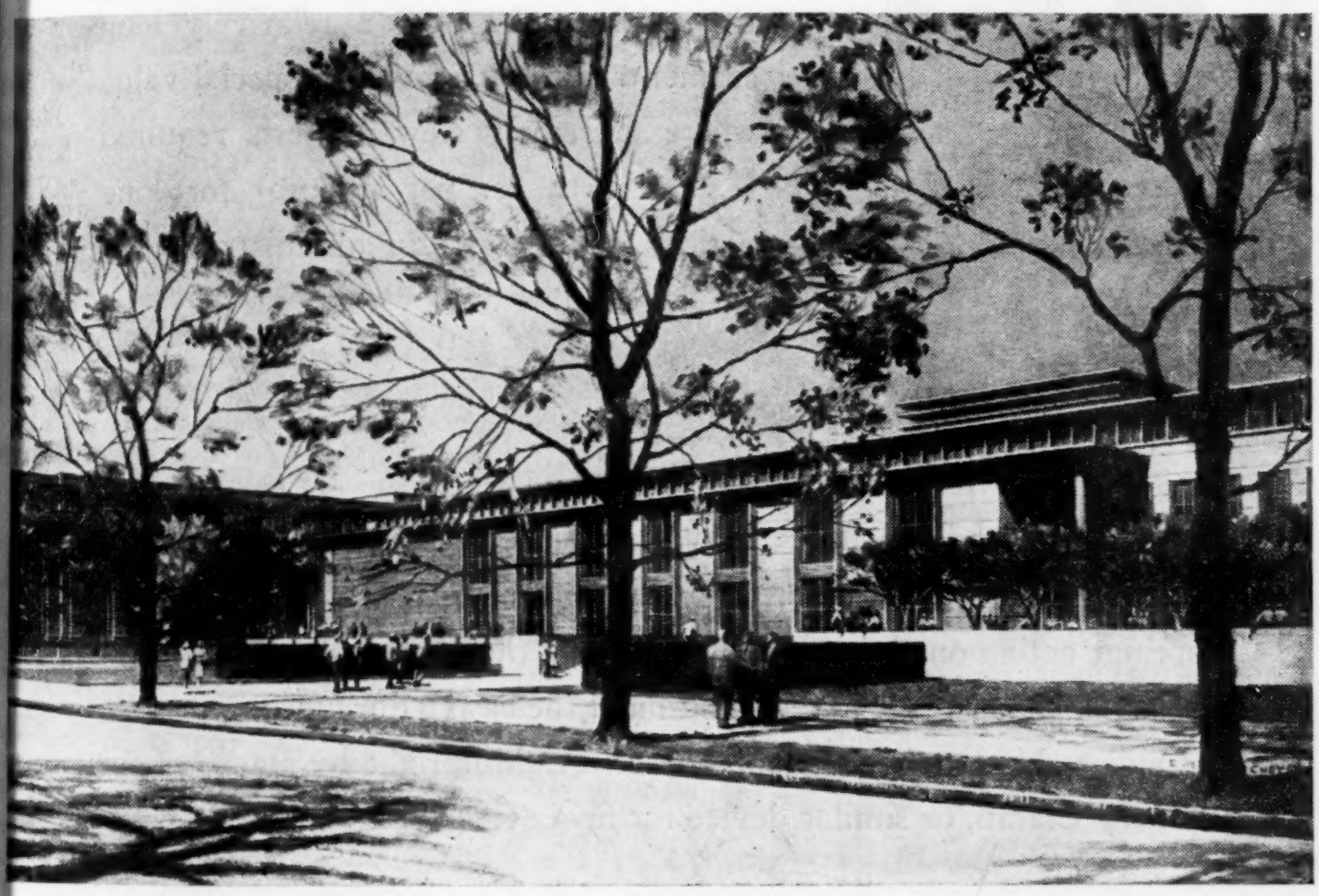
Science

THE SCIENTISTS NEWSWEEKLY

April 25, 1947



Façade of the proposed Charles Hayden Memorial Library at Massachusetts Institute of Technology, Cambridge, Massachusetts. The Library, to be constructed in the near future with funds received from the Charles Hayden Foundation, will be situated between the main educational buildings and Walker Memorial, facing the Charles River (see *News and Notes*).

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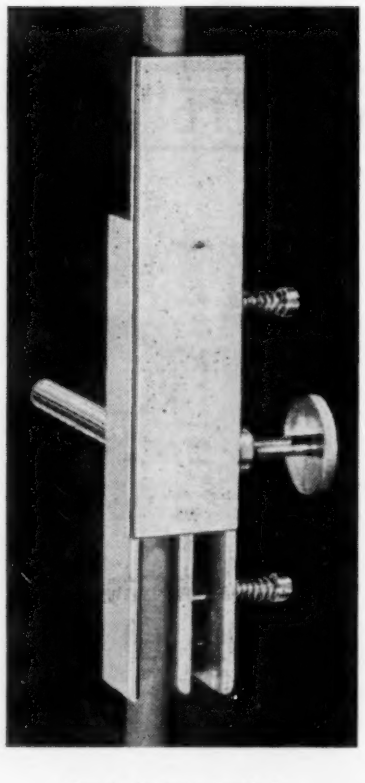

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Vol. 105 No. 2730 Friday, April 25, 1947

Science

CONTENTS

International Exchanges:
Robert B. Downs 417

The Army Medical Library:
Richard Hood 422

News and Notes 427

Comments by Readers 432

Technical Papers

The Cytological Effects of Podophyllin: *B. J. Sullivan* and *H. I. Wechsler* 433

The Phosphorescence of Chlorophyll and Some Chlorin Derivatives: *M. Calvin* and *G. D. Dorough* 433

Rate of Vaporization of Sulfur: *F. M. Turrell* 434

Effect of Streptomycin on the Metabolism of Certain Mycobacteria: *Frederick Bernheim* and *R. J. Fitzgerald* 435

Suppression of Axillary Growth in Decapitated Tobacco Plants by Chemicals: *Robert A. Steinberg* . . . . .

Crystalline Kitol: *F. B. Clough, et al.* . . . . .

In the Laboratory

Production of Quantitative Infections With the Filariae of the Cotton Rat: *J. Allen Scott* . . . . .

A Simple Method for Administering Nebulized Penicillin: *David Glusker* . . . . .

An Interphase Analyzer of the Electroencephalogram: *Harry Sonnemann* and *Margaret A. Kennard* . . . . .

Effective Copying of Kymographic Records: *O. S. Gibbs*

An Adaptable Three-dimensional Graph Model: *James W. Brown* . . . . .

Book Reviews

Domestic . . . . .

Foreign . . . . .

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International Exchanges

Robert B. Downs, *Director,*
University of Illinois Library, Urbana, Illinois

IN THE TEXT OF THE THREE-POWER STATEment on atomic energy, released in November 1945, there are several references to the desirability and necessity of interchanging scientific information. "Scientific literature" is mentioned specifically. This is believed to be the first time on record that the heads of three great governments have jointly advocated the exchange of scientific publications. Other evidence pointing in the direction of growing recognition of the importance of international exchanges is the extensive use of scientific publications by the General Staffs, the unprecedented demands made upon libraries by wartime research, and the regrettable frequency of calls for foreign publications not available anywhere in this country. Mention should also be made of the attention paid to foreign scientific and technical books and journals by the Alien Property Custodian; the careful scrutiny and digesting of enemy documents, still in process; and the distribution of information from these sources to American industry. It seems obvious that, as Vannevar Bush has commented, "adequate technical libraries are an indispensable tool for research workers."

Support for the idea of international exchanges has come also from another source, the United Nations Educational, Scientific, and Cultural Organization. The UNESCO constitution states as one of the primary functions of that body the maintenance, increase, and diffusion of knowledge "by encouraging cooperation among the nations in all branches of intellectual activity, including the international exchange of persons active in the fields of education, science and culture and the exchange of publications, objects of artistic and scientific interest and other materials of information; [and] by initiating methods of international cooperation calculated to give the people of all countries access to the printed and published materials produced by any of them."

The role to be played by the United States in any plan for international intellectual cooperation will undoubtedly be of first importance because of the advanced state of scientific progress here, our efficiently organized libraries and other cultural and educational institutions, wide experience in the international exchange field, well-developed bibliographical services, and like factors. It is certain that a large measure of national initiative will be essential to the success of any such comprehensive program as UNESCO is contemplating.

The interchange of literature, information, and personnel on a world-wide scale is, of course, a problem with numerous ramifications. It involves, for example, exchange of publications between institutions; exchanges of official documents among governments; commercial exchanges; national bibliography; indexing and abstracting organs; cooperative acquisition agreements among libraries; reproduction of research materials; copyright, tariff, and postal regulations; interlibrary loans; traveling exhibitions; and reconstruction of war-devastated libraries. Certain major aspects of these and related problems will be reviewed briefly here.

Exchanges Between Institutions

International exchanges of publications between universities, learned societies, and other agencies are chiefly concerned with institutional publications, particularly current serials, on a title-for-title basis. Comparatively few American libraries—probably not more than 100—have benefited substantially from foreign exchanges. The most active exchange programs are carried on by large universities having strong presses associated with them and willing to allot sufficient funds and material for the purpose. When properly supported, exchange relationships with organizations abroad have proven extremely profitable. Several difficulties, however, are still unresolved, even though the exchange movement in the United States began at least three generations ago. No list of foreign publications available for exchange is in print, and, consequently, arrangements must be negotiated directly between libraries, frequently on a hit-or-miss basis. One result is many gaps and much unevenness in library collections. Another problem arises in connection with the Smithsonian Institution's International Exchange Service, an agency subsidized by Congress to transmit foreign exchanges (*Science*, August 9, 1946). As the system is now organized, individual libraries ship materials to the Smithsonian in Washington. From there the materials are forwarded to a foreign national bureau, which then transmits them to the receiving library. Actual delivery of publications under this plan is often excessively slow, perhaps requiring as much as six months time, because shipments are allowed to accumulate and are then sent by slow ocean freight. Such delays may be quite serious in the natural sciences, for example, if

This article is based in part on proceedings of a Conference on International Exchanges, sponsored by the American Library Association, held at Princeton University, November 25–26, 1946.

research on a particular problem is under way simultaneously in two or more countries. The solution would appear to be in the use of air freight, or in sending microfilm copies by air post, for the most urgently needed publications. To deal with the entire problem of exchanges between institutions, possibly a central coordinating agency is needed in each nation to expedite arrangements, to secure more complete coverage, and to stimulate the forming of exchange relationships.

Incidentally, the needs of scholars and scientists in the United States require the resumption of normal cultural, educational, and scientific relations with former enemy countries as promptly as possible. Many American universities, learned societies, and research libraries are holding shipments of their publications, especially for Germany and Japan, awaiting removal of wartime restrictions on transmission of such materials. At the same time, they wish to receive scholarly publications from functioning institutions in the ex-enemy nations. A high proportion of such material is of no military significance whatsoever, but does have a direct relationship to the activities of American scholars and research workers. At present, publications from Germany and Japan can be obtained, if at all, only through military channels and with great difficulty. There seems to be no alternative to opening normal peacetime communications except sending special missions on the War Department's authorization, and this procedure is expensive, slow, and cumbersome.

Exchange of Government Publications

Because of the expense involved, lack of bibliographical information, restrictions on distribution, limited demand, and space requirements, only a limited number of American libraries have been able to develop adequate collections of publications of foreign governments. Nevertheless, research workers are intensifying their interest in foreign documents—an interest which received its greatest impetus during the war years and is increasing with the continued emphasis on international organizations of all sorts. The Library of Congress is designated by Congress as the official recipient of foreign documents coming, by treaty or executive agreements, from other governments in exchange for our own Federal publications. A single copy in the national capital falls short, however, of meeting the demand. The need might be met, on the other hand, by the designation of certain strategically located centers in the United States to receive all important foreign documentary publications in exchange for official American publications to be sent to depositories abroad. Countries not wanting additional sets of publications of our Federal Government could be offered state documents or nongovernmental books and journals. In view of its strategic position, the Library of Congress is the logical agency to serve as a clearinghouse and coordinator for an expanded scheme of distribution of foreign official material.

National Bibliography

One of the major obstacles to international exchange is lack of information concerning the publishing output of various countries. Few nations maintain adequate records of book production. The gaps are conspicuous for virtually all Latin America, the Far East, and most of the minor countries of the world. Retrospectively, the situation is less satisfactory than that for current publishing. In the case of Italian printing, for example, national bibliography is almost a blank from 1500 to 1850, a 350-year period. Even in countries which have long been active bibliographically, the record is incomplete, e.g. 18th-century English printing and American printing for the first three quarters of the 19th Century. The United States is certainly now the leading nation in bibliographical matters, yet none of the three principal media for listing current imprints—the *Cumulative Book Index*, the *Publishers' Weekly*, or the Copyright Office's *Catalogue of Copyright Entries*—is more than a partial record of American publishing. Omitted are nearly all government documents, periodicals, newspapers, many private press imprints, a majority of pamphlets, and a considerable percentage of noncommercial and institutional material.

To achieve reasonably complete coverage of world book production is a Gargantuan bibliographical task. It calls for the full cooperation of UNESCO, the International Federation of Documentation, national governments, national libraries, library associations, pertinent commercial organizations, and any other agencies having an interest in finding a satisfactory solution. In countries with limited resources and little bibliographical background the stimulus must come from the outside.

The bibliographical treatment of periodicals calls for special comment. Particularly needed is a world list of current periodicals, noting such information as inclusion in abstracting and indexing services, availability on exchange, subjects covered, and all essential bibliographical details. The lack of a work of this kind is keenly felt during the present period when many periodicals abroad have discontinued, new journals have started, and national directories of periodicals have suspended publication. Negotiations for exchanges and purchases can hardly begin when the very existence of a journal is not definitely known. During the war the Library of Congress undertook the compilation of a union list of American holdings of scientific and technical periodicals issued in the Axis and Axis-controlled areas. This tool proved of frequent research value in the war effort and was especially useful because of its location feature. The list should now be expanded to serve as a guide to libraries trying to fill gaps in their files and as a basis for a republication program.

Indexing and Abstracting

Closely related to the whole periodical situation is the question of abstracts and indexes. In this field there are serious problems of overlapping, with abstracting and indexing services in different countries, or even the same country, covering the same materials. On the other hand, contrasting with this unnecessary and expensive duplication of labor there are numerous valuable journals and broad areas (the social sciences, for instance) now omitted from any indexing medium. Careful consideration should be given to determining what kinds of activities—national and international—will reveal most satisfactorily the results of research in all countries. The disappearance of the German indexing and abstracting publications left a substantial void, and the United States, with its vast resources, has an excellent opportunity to step into the breach. Such complex problems must be solved, however, as finding qualified abstractors to deal with scientific and other literature, in a variety of languages, throughout the world; deciding whether indexes and abstracts should be complete or selective; obtaining funds, amounting to hundreds of thousands of dollars annually, for preparation and publication; and, finally, overcoming the difficulties of getting access to journals of all countries. As a first step, to help define the size of the undertaking, it would be desirable to have a world bibliography of indexing and abstracting periodicals, giving under each title a list of publications indexed or abstracted. Such a tool would serve as a guide for the establishment of new indexing and abstracting organs and for reduction of duplication of effort.

Reproduction of Research Materials

The problem of reproduction of research materials divides itself into three parts: the need, the technical processes, and the potential uses. Because of destruction of research materials during the war years, the limited editions in which books and journals were issued in countries at war, and the increasing demands for materials on the part of libraries, scholars, and research workers, it has long been apparent that the available supply will fall short of requirements. The dilemma can be met satisfactorily only by an extensive program of reproduction by printing, photo-offset, microfilming, microprinting, or other methods. Here, too, international cooperation will be essential. It will be far more economical, for example, for a publication to be reproduced only once, to supply the demand in all countries, than to have each nation repeat the process separately. This would seem to call for the establishment of a central agency, or agencies, to coordinate the reissue of journals and other materials needed by American and foreign libraries and to determine what titles are in sufficient demand internationally to produce in the original size, in reduced facsimile, or by microfilm. Because of gaps in information, it might be necessary to develop, to some extent, bibliographies of publications of the war years before items which should be reproduced can be identified.

Also a part of the same field is international cooperation in the improvement of methods of reproducing library materials. Much experimentation and research are needed, as, for example, in microfilm and microprint techniques and mechanical indexing systems, before a reasonable degree of perfection is reached. As one instance, is the Rider "microcard" proposal capable of being developed to a point where it will be a feasible tool for the large-scale reproduction of research materials? Or, again, what are the comparative costs of reproduction, by the several processes now in common use, of materials of different lengths, types, and in varying numbers of copies? Closely related to the problem is a definite need for adoption of an international code of standards for technical reproduction. Interchanges of material are now handicapped by variations in practices and work quality.

A third phase concerns use. Studies are needed of the use of microreproductions for interlibrary loans, for exchanges between institutions, and to determine how satisfactorily reproductions serve the purposes of the scholar and student. In view of the hazards of transportation, extensive lending of original materials between countries is not practicable, and we must look toward increasing utilization of microfilm or other photographic reproductions to replace originals. The idea of international interlibrary loans is, of course, appealing and idealistic. In happier days it apparently worked well in western Europe, but, from a realistic point of view, there is considerable risk now of damage or loss in sending valuable materials across oceans and other great distances, and other means must be found. Uniformity in international interlibrary loan practices might be achieved by the establishment of a national clearinghouse in each country. The Library of Congress would be the natural center for the United States and could make decisions on whether original publications, films, or photostats should be sent.

Coordination of Book Acquisitions

From a practical point of view, it is impossible for even the largest libraries to hold more than a fraction of the world's literature. Originally under the sponsorship of the Library of Congress, and more recently taken over by the Association of Research Libraries, a far-reaching plan is being developed for cooperative coverage of foreign publications by American libraries. The aim, in brief, would be accomplished by having participating institutions, each of which would agree to specialize in one or more given divisions of knowledge, acquire at least one copy of every book of potential research value published anywhere in the world. The 45 institutional members of the Association of Research Libraries, supplemented perhaps by an equal number of nonmember libraries,

have the financial and other resources necessary to put this program into effect, and there is every probability that rapid progress will be made with it. The mechanics of the program are still to be developed, but purchasing methods will need to be coordinated for economy and speed. The usual pattern of checking national bibliographies, making selections, and ordering individual items from various dealers is not applicable to mass purchasing. Instead of each library negotiating separate contracts, it is probable that one or more responsible central agencies will be set up in each country to select and ship material to cooperating libraries.

As a corollary to the American plan, similar arrangements are even more necessary abroad. In view of the devastation they have suffered and the acute problems they face in restoring their book resources, European libraries should work out acquisition agreements among themselves. It is important for these libraries to obtain a wide coverage of research materials, even if only in a limited number of copies, and this can best be achieved on a coordinated basis. If understandings of the nature indicated could be reached in the areas receiving aid from agencies in the United States, the reconstruction of foreign research libraries would be greatly facilitated.

Reconstruction of Foreign Libraries

Many libraries in war areas suffered devastation ranging up to complete destruction. Library associations, individual libraries, learned societies, foundations, and relief organizations have performed notable service in aiding war-damaged libraries. The American Book Center, a cooperative agency set up in the Library of Congress for this purpose (*Science*, August 2, 1946), has distributed hundreds of thousands of volumes to libraries abroad, and its activities are continuing. The Inter-Allied Book Centre in London is performing a similar function. Appeals continue to be received, however, and needs have been met only partially. It has been suggested by several persons closely in touch with the situation that the aim should be reconstruction rather than rehabilitation of libraries. This means, in some instances, placing materials where they would be most useful rather than attempting to restore the prewar status. The proposed policy would be to determine what institutions should be strengthened and then to concentrate in them any resources that could be provided. Preferential treatment would be given those libraries that suffered heavily in the war only if their restoration would prove of greatest benefit to the nations in which they are located. It is suggested further that in most devastated countries there are established agencies which could advise on most effective placement of materials.

Copyright, Tariff, and Postal Regulations

Without question, three of the chief impediments to the free flow of ideas across national boundaries are copyright, tariff restrictions, and postal regulations. The question of copyright, for example, immediately comes to the fore in considering the reproduction of books, journals, and other research materials, even though the original editions may be completely inadequate to meet the demands. In 1935 a "gentlemen's agreement" was reached between the Joint Committee on Materials for Research and the National Association of Book Publishers, whereby libraries are permitted, extralegally, to make reproductions for research purposes. No such principle of fair use, or rule of reason, has ever been incorporated in the copyright law, even though library and publishing interests are not in conflict. The present law handicaps American libraries when they are called upon to microfilm single copies of American books for the use of foreign scholars. The War Department is reported to have met with some success in persuading authors to waive their royalty rights on translations to be used in the occupied countries in order to spread the results of American scholarship of the past few years.

By increasing prices, tariffs restrict the distribution of publications from one nation to another, further limiting scholars' access to the world's knowledge. One such instance is our own Treasury Department's requirement that consular invoices be presented for import shipments of library printed materials. Postal regulations also serve as a deterrent to the general distribution of published materials across national borders. A possible solution is adoption of an international book post system, to reduce postage and expedite transit.

It is quite apparent that no more important or perplexing problem faces UNESCO, libraries, learned societies, and other interested organizations than the removal of these barriers to the free flow of informational materials.

Translations

Both the State and War Departments have successful translation programs for overseas use, and these projects have turned out to be of great value in informing foreign peoples about the United States and in making widely available the works of American scholars and other writers. In our cultural relations with other nations there is a need for translations of both popular and technical literature. Also needed is a comprehensive international record of printed translations. For this purpose, a revival of the *Index Translationum*, published annually from 1932 to 1940, or a similar compilation would be useful. It has been suggested further that machinery should be established through which publishers might organize, possibly under the sponsorship of UNESCO, to exchange translation rights. Such an agency would aid in determining what works should be translated and would facilitate settlement of copyright and other problems.

Exhibits

A direct and effective method of informing world scholarship of the results of research everywhere would be traveling exhibitions of publications. It would be practicable, for example, to select several hundred of the most significant European publications of a particular year and to circulate the collection for exhibition purposes to the principal research centers of the United States. A similar group of American works could be sent to Europe, Latin America, and elsewhere. Possibly the larger libraries, public and academic, could devote a certain portion of their display facilities to such exhibits continuously. Apart from the value of traveling exhibits for bringing foreign books to the attention of scholars and informing the libraries' general clientele, the collections would be useful also in guiding library buying and helping to fill in gaps of important books that might otherwise be overlooked.

Interchange of Personnel

The principle of international exchange of students is well established. International travel by college and university professors on sabbatical leaves is also traditional. Further interchanges of this character should be encouraged, because of their favorable effect on relations between scholars of different nations. In addition, ways should be found to facilitate interchange of specialists in various fields, from one country to another, to aid in the study and solution of particular problems.

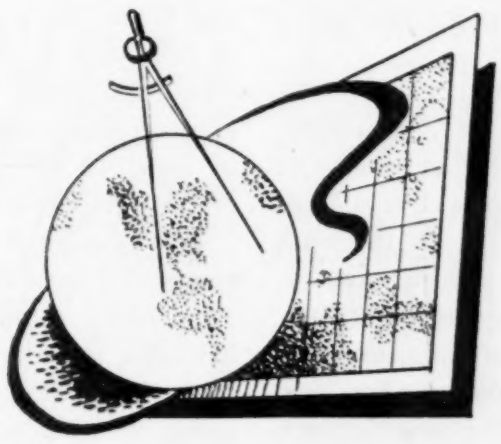
Specifically in relation to libraries, the American information libraries, established abroad, principally under the State Department's direction, during and since the war, have served as excellent training grounds for American librarians, as well as introducing foreign peoples to one of the most democratic of American institutions, the free public library. All the available evidence indicates that these libraries have contributed greatly to the spread of American culture and to a sympathetic appreciation of the United States in foreign lands.

The State Department has also strengthened the cultural relations program by bringing foreign librarians to the United States. Experience has shown, however, that librarians who wish to take advantage of this opportunity should be carefully screened, that they should spend an orientation period of visiting or study in this country before beginning work, and that consideration should be given to the type of work they are to do after returning home. The lack of training agencies for librarians in other countries emphasizes the strategic place occupied by American library schools.

Before further expansion, a thorough study is desirable of both the needs and the geographical areas that might be served by the personnel exchange program and the mechanics of the program.

The foregoing discussion outlines some of the principal features of international exchanges, broadly interpreted, as they relate to libraries, educational institutions, and cultural organizations in general. It is appropriate that the United States should assume leadership in the field. Our own cultural productions were not severely curtailed by the war; our financial and personnel resources are strong; and our libraries and scholars are ready to absorb and use the publications of all countries.

The free interchange of cultural, scientific, and educational information is unquestionably one of the most critical needs of the world today. Society's progress depends upon the extent to which scholars and scientists have unrestricted access to all sources of information. Likewise, international understanding requires that the cultural records of every nation be fully available to all other nations. Finally, intelligent and informed world opinion must be based upon the wide dissemination of educational materials. These are our stakes in efforts to perfect the machinery for international exchanges.



The Army Medical Library

Richard Hood

Army Medical Library, Washington, D. C.

ON THE SOUTH SIDE OF THE MALL IN Washington, D. C., at the corner of 7th Street and Independence Avenue, next to the Smithsonian Institution, stands an old, red brick building which houses such portions of the Army Medical Library and the Army Institute of Pathology as can be accommodated within its walls (Fig. 1). Since 1836 the Army Medical Library, formerly known as the Surgeon General's Library, has grown from a small collection of books to one of the greatest collections of medical literature in the world. It has grown from a small reference library to a great national research library, known throughout the world both for the size and completeness of its collection and for the printed catalogue of that collection, the *Index-Catalogue*. A famous American physician, the late William H. Welch, once said that the Library and its *Index-Catalogue* were one of America's great contributions to medicine.

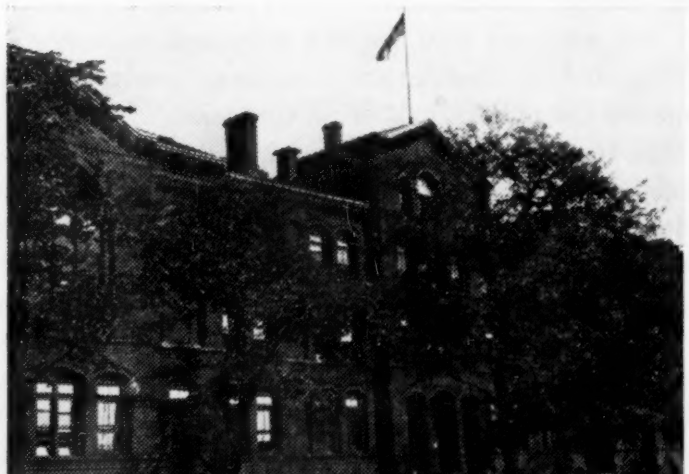


FIG. 1. Present Army Medical Library building, Washington, D. C.

This phenomenal growth was almost entirely the result of the vision and efforts of one man, John Shaw Billings, who came to Washington in 1865 to become an assistant to Surg. Gen. Joseph K. Barnes. Dr. Billings seems to have had the ideal personality for the work ahead. He was a man of affairs; he thought and organized far ahead, on broad lines and in many directions, as his output of 171 publications in the course of half a century bears witness. As a bibliographer, he has been compared with Albrecht von Haller of the 18th Century. He also achieved eminence as a vital and medical statistician, serving actively in preparing the reports of the 10th (1880) and 11th (1890) censuses of the United States. In addition, he was often called on for advice on public health matters and the planning of hospitals.

Almost at once Dr. Billings perceived that the accommodations for a library in the Surgeon General's Office were woefully inadequate, that there was a great need for an analytical catalogue of world medical literature, and that to complete such a catalogue a very extensive collection of medical literature must be available in one building. The next 30 years of his life were devoted to the accomplishment of these tasks.

A letter from him to the secretary of the Medical Society of the County of New York, dated February 3, 1880, gives some figures on the extent of the collection at the time of his arrival. In this he wrote: "When the Library came under my charge in the fall of 1865, it contained, as shown by a catalogue made at the time, about 1800 volumes."

In 1868 the sum of $80,000, remaining from Civil War hospital funds, was made available to Dr. Billings, and he began his great work of collecting and cataloging medical literature. At the time of his departure in 1895, the collection included 310,000 items (117,000 volumes and 193,000 pamphlets).

Through the years the Library's collection has become so large and so well known to the medical profession that its services extend far beyond the Medical Department of the Army. Many related subject fields, such as dentistry, nursing, and veterinary medicine, are represented. The Library also contains a great number of the earliest printed books, pamphlets, and periodicals, including over 500 incunabula.

The collection of early manuscripts from European and Oriental sources and the extensive collection of rare 16th- and 17th-century medical works is of particular interest. A collection of theses published at the University of Paris, considered the most complete in existence, receives constant use. There is also a medical art collection of some 12,000 items, with references to more than 50,000 portraits and illustrations.

The Document Section is attempting to assemble as complete a selection as possible of official health publications of all countries so that vital statistics may be available for any region. Dr. Billings' recognition of the value of statistics had led to an early start of this phase of the collection. The addition in 1922 of a large vital statistics collection of the Prudential Life Insurance Company enhanced the value of these holdings.

Today, under the general directive that "the Library's collections shall contain the medical literature of the world, regardless of language, form, or date of publication," the Acquisition Division shapes its policies to acquire such items as a new medical periodical published in Leningrad, weekly vital statistics from Mozambique, materials on opthalmology from Egypt, on public health in China, and on tuberculosis in Russia. In all, over 67,000 pieces including books and serials were added to the collections in 1946.

Current medical literature and publications unavailable during the war are being received in increasing quantities. Over 4,500 current serial titles in almost every language are regularly recorded. Through the Library of Congress Cooperative Acquisition Program and the increased acquisition activities of the Library itself during the past two years, it will be possible to provide almost complete coverage of postwar German medical publications and probably 80 per cent of all German medical publications of the war years.

In addition to this global coverage of current medical literature, the Library works constantly to fill any gaps in the basic collection. This continuing enrichment of the collection contributes to the steady growth of the Library's reputation as the finest source of materials for medical history. In all, the Library owns over 1,000,000 items, of which at least 500,000 are bound volumes. There are some 17,500 files of periodical titles.

The servicing of this vast accumulation of medical information is the function of the Library's Reference Division. This service supplies medical publications to the Armed Services, local physicians, institutions, and libraries throughout the country. With these exceptions, the Army Medical Library does not lend books directly to individuals; such loans must be secured through local libraries. To fill requests, large numbers of books are sent out each year on interlibrary loan for a two-week period with renewal privileges. As a service to the research worker, selected bibliographies, either brief or extensive, and covering a wide range of subject matter, are compiled in the Reference Division. Telephone inquiries and letters of great variety are received constantly and are answered as promptly as possible.

Since December 1940 the Army Medical Library has been providing a photoduplication and microfilm service on a global basis in the interest of medical research. This is designed primarily to make available to the personnel of the Medical Department and the medical profession at large the literature of the Library's collections. During World War II millions of pages of microfilmed articles were supplied to the Armed Services and other research agencies. By agreement with the Office of Technical Services, Department of Commerce, the Library is a depository for captured German and Japanese documents on medical subjects, which are available through this photoduplication service. The service is now generally available to civilian physicians, institutions, and research workers on a cost basis. The charges are nominal. Material so filmed is, of course, not to be used for reproduction without permission of the copyright owner.

The *Index-Catalogue*, a publication which plays a fundamental role in medical research as a subject bibliography and which has become the foundation for medical library service both here and abroad, is a contribution which owes its origin to the vision and energy of John Shaw Billings. In 1876, nine years after assuming charge of the Library, Dr. Billings realized another one of his cherished ambitions with the publication of the "*Specimen Fasciculus*", which was to serve as a pattern for the *Index-Catalogue*. Established by an Act of Congress in 1879, the *Index-Catalogue* is a medicobibliographical survey carried out uninterruptedly by the U. S. Government. The 56 volumes printed to date list 3,282,405 references, 2,796,435 of which are arranged under subjects. The present volume covers the letter M of the Fourth Series. The number of references revealed by both the printed and the manuscript *Index-Catalogue* amounts to almost 5,000,000, all of which are available in the Army Medical Library. The printed edition is found in numerous public and medical libraries and in many cases is used as an index to their own collections.

After the assassination of President Lincoln in 1865, the Library was set up in Ford's Theater on 10th Street, where it remained until Dr. Billings' plans for a new building were realized in 1887. In that year the collection was installed in the building at 7th and B Streets (now Independence Avenue).

By the time Dr. Billings left the Library in 1895 to become director of the New York Public Library, two men selected by him were already carrying forward his work. Fielding Garrison, who retired in 1930 with the rank of Colonel after nearly 40 years of service to the Library, was editor of the *Index-Catalogue*. Robert Fletcher, another Billings appointee, served as editor of the *Index Medicus*, which had been started in 1876. In 1927 this publication merged with the *Quarterly Cumulative Index* of the American Medical Association, becoming the *Quarterly Cumulative Index Medicus*.

From 1895 to 1936, 12 Medical Corps officers served for various periods as librarians. Garrison had this to say of Billings' successors in office:

> The official management and administration of the great library, the selection and purchase of its books, the selection of material for indexing, the enlargement and improvement of its resources, passed into the hands of the Army medical officers who succeeded Billings. As the cantors of the Thomasschule at Leipzig, the successors of Bach, had to be men learned in counterpoint, worthy followers of the great seventeenth century music master, so these Army surgeons have been men specially selected for their scientific and literary attainments. Huntington, one of the collaborators of the Medical and

Surgical History of the War of the Rebellion; Merrill, distinguished by his work in ornithology; Walter Reed, a pupil of Welch and discoverer of the causal nexus and mode of transmission of yellow fever; and Walter D. McCaw, who specialized in tropical medicine and added greatly to the unique historical collections of the Library, have all been imbued with the spirit of enthusiasm and the interest in the literary side of medicine which Billings brought into his work.

In 1936 Col. Harold W. Jones became the librarian. Col. Jones served for the next 9 years, including the war period—an important one in the Library's history. The year 1936 also marked the first 100 years of the Library's existence. The centennial was celebrated by a gathering representative of the medical profession and the Army on

Interlibrary loans and reference services were increase
and through the introduction of photoduplication
became possible to provide a world-wide medical info
mation service.

Another Library publication is the *Current List*
Medical Literature, started as a private enterprise in 19
by Atherton Seidell under the sponsorship of the Medic
Library Association. In September 1945, its value havi
been amply demonstrated, it was taken over as an int
service publication by the War Department. Publish
weekly by the Army Medical Library, it is design
primarily to serve the individual engaged in medic
research by enabling him to glance each week at t
contents of journals in his field and find each mon

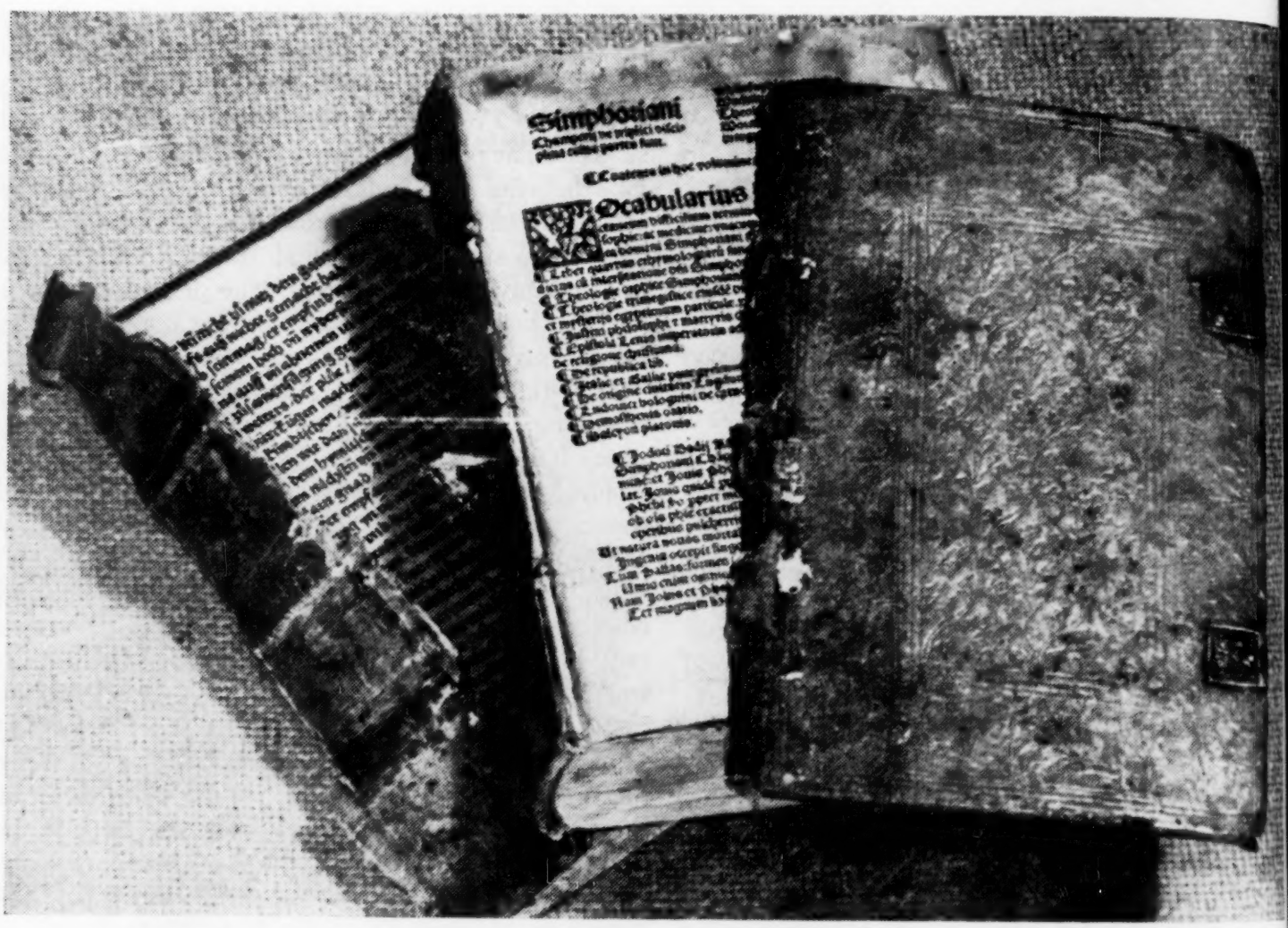


FIG. 2. Champier, *De triplici diciplina*, 1508, before restoration.

November 16 of that year. Greetings received from governments and institutions throughout the world bore witness to the position of leadership in its field which the Library had achieved. An article in the January 1937 issue of *The Military Surgeon* describes the gathering which met to do honor on this occasion as "an assemblage of guests, noted in bibliography and medicine and library science, as is seldom beheld."

In the years which followed, particularly those immediately preceding the war period, many changes were made which led to an expansion of the Library's services.

through the subject index, articles published elsewhe
on the subjects in which he is interested. It is also d
signed to be an interim aid to the librarian betwe
appearances of other indexes of more permanent valu
The subject headings used are those of the *Quarter*
Cumulative Index Medicus, to which the readers m
refer for necessary cross references. The *Current Lis*
available to personnel and installations of the Medic
Corps and Federal agencies on request addressed to th
Commandant of the Library.

Overcrowding, as well as lack of air-conditioning, ha

aken an irreplaceable toll among the older volumes of e collection through the years. The History of Medicine ivision of the Army Medical Library was established in leveland in the summer of 1942 to receive and care for a art of the Library's collection which it seemed desirable place out of probable bombing range and for which here was no longer room in Washington. This included early all the Library's books printed before 1801 and uch of the noncurrent material in the medical docuents and vital statistics collection. A program of repair d rehabilitation of this valuable material has been nducted in this Division (Figs. 2 and 3).

The Library, relying as it did on the printed *Index-atalogue*, has never had a conventional card catalog of its holdings. In 1944–46 an inventory was made on cards as a preliminary to a complete card catalog. In March 1946 permanent descriptive cataloging of the collections was begun.

There has been no classification subject groupings other than alphabetical arrangements under broad subject groupings. This deficiency, which had resulted in great handicaps to public service, was recognized early in the war. As there was no existing classification adequate for the collection, a new classification for medical literature was prepared by a committee of advisers. In October 1946 this new classification was applied for the first time to books currently received.

The cataloging and classifying of the million titles in the Library will be a stupendous task; no other major research library has undertaken such an extensive reorganization. Upon completion of the work, which will require 10–15 years, the Library will be able to provide finger-tip control over the medical literature in its possession.

Early in 1943 a committee of leading civilian authorities, sponsored by the American Library Association and financed by the Rockefeller Foundation, conducted an intensive survey of the Library and its activities and presented a series of recommendations of a sufficiently long-range character to offer a reorganization suited to future needs. Most pressing among these was the need for a new building to replace the present cramped quarters, occupied by the Library in Washington since 1887. The committee also stressed the importance of building up a professional staff with a modern library organization through which it could function. Since 1943 the staff has been increased from 58 to 128. Through its professional training and abilities it is a credit to a great institution.

The recommendation of the Survey Committee that a new building was an absolute necessity has yet to become

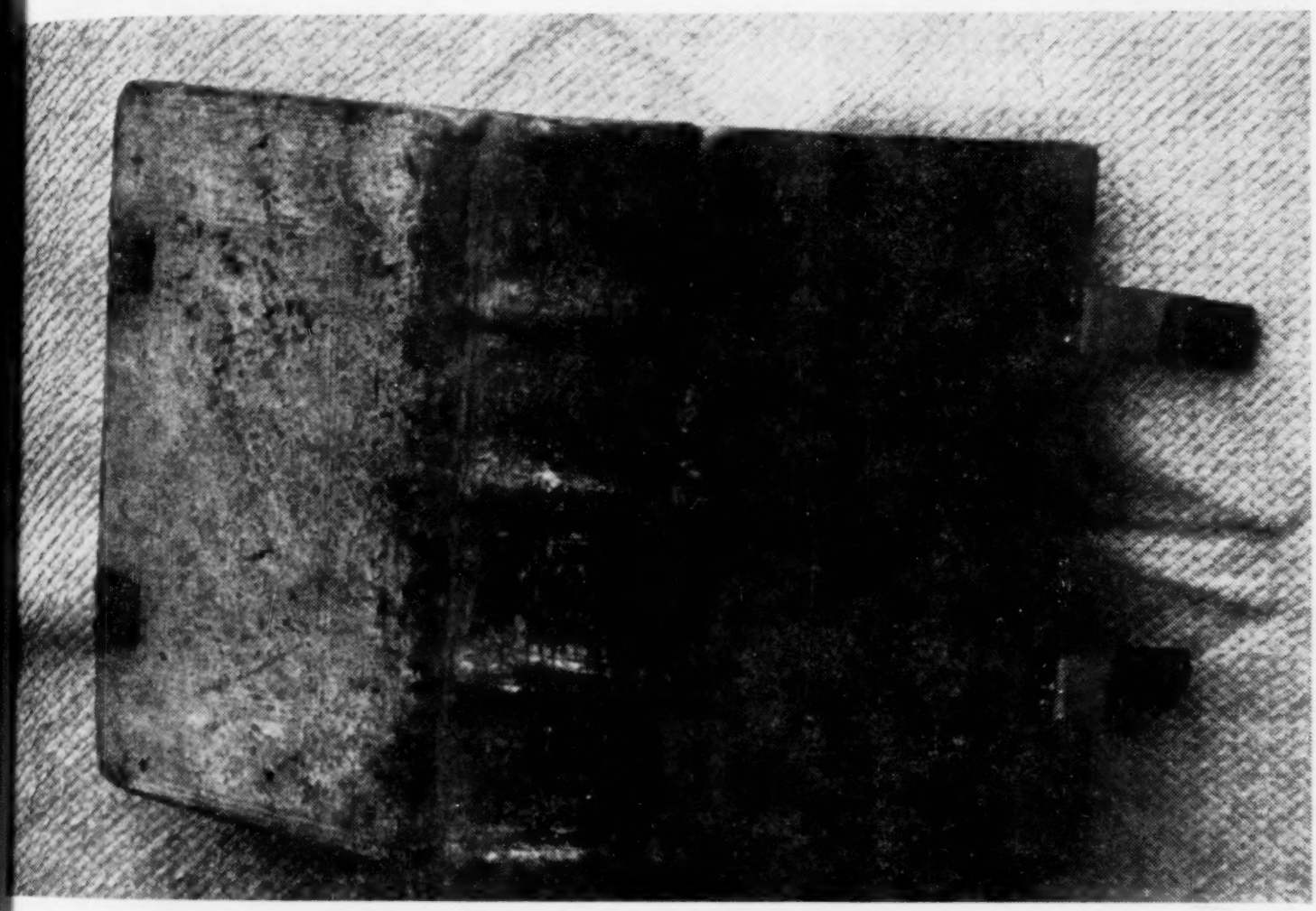


FIG. 3. Champier, *De triplici diciplina*, 1508, after restoration.

an accomplished fact. In 1940 the sum of $130,000 was appropriated for plans. After extensive consultations with the librarian and an advisory board of medical officers, blueprints and artists' drawings were made by the architects, Eggers and Higgins of New York, who spent approximately a year in developing the general plans (Fig. 4). The advent of World War II resulted in

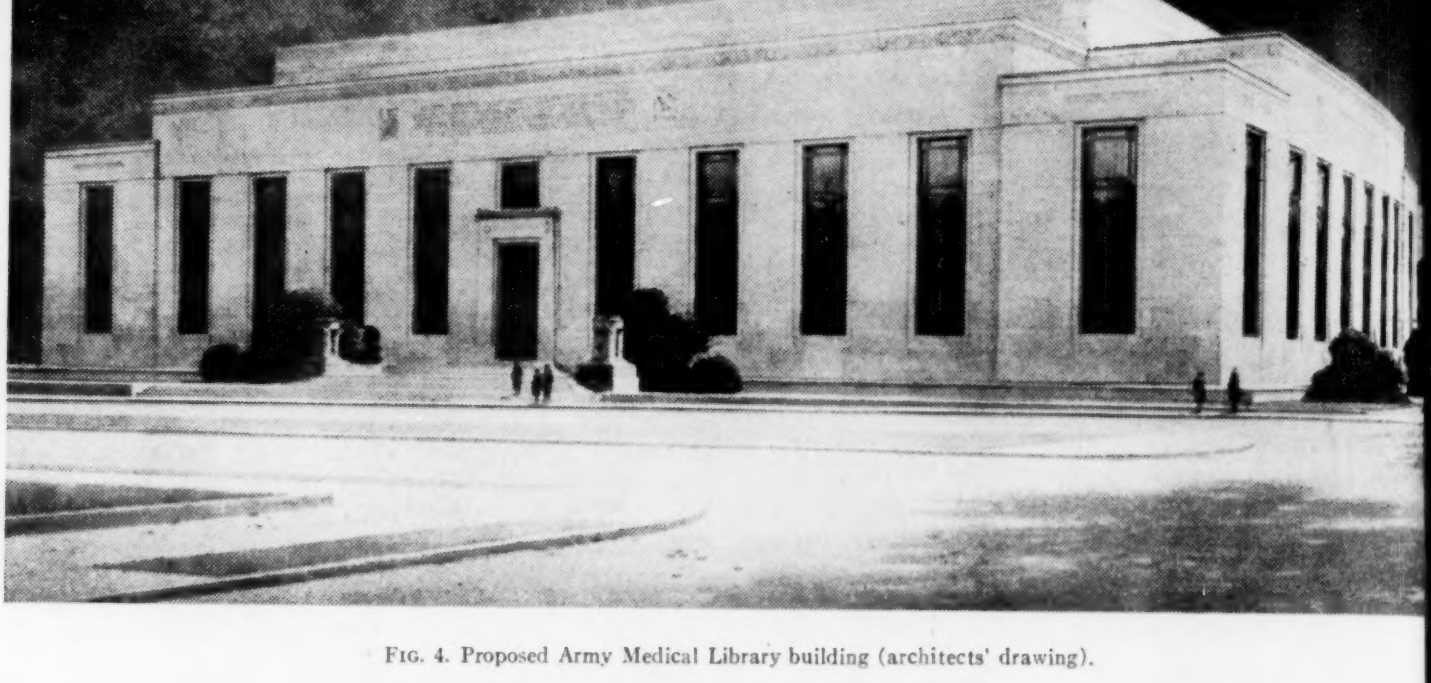


FIG. 4. Proposed Army Medical Library building (architects' drawing).

postponement of all activity leading toward the immediate erection of a new building. However, in anticipation of eventual action which will provide for the essential needs of the Library, further study has been given to the original drawings. The Library looks forward to the time when a building can be secured which will not only be adequate for present needs but which will anticipate the growth of the collection. The location has been selected, adjoining the Library of Congress on Capitol Hill, where

the resources of the Library will be accessible to scholars from all parts of the world.

The Association of Honorary Consultants to the Army Medical Library, an organization which is an outgrowth of an advisory board of outstanding physicians and librarians appointed by Surg. Gen. Patterson in 1936, acts as an advisory body to the Surgeon General

library matters. This Association, the current president of which is John Fulton, professor of physiology at Yale University, is most active in support of the Library.

Through a close working arrangement with the Library of Congress and other Federal research libraries in Washington, the Army Medical Library is able to offer almost unlimited resources in its field. This great medical research library must continue to build and interpret its collection in support of medical progress.

NEWS
and Notes

Plans for a new library at Massachusetts Institute of Technology have been announced by President Karl T. Compton. The structure, to be known as the Charles Hayden Memorial Library, is made possible by a gift of $2,200,000 from the Charles Hayden Foundation, one of the largest single gifts ever received by the Institute.

According to President Compton, the Library will serve a dual purpose. Not only will it be the nucleus of the departmental libraries, thus providing the most useful possible collection of advanced research and teaching material in science, architecture, and engineering, but it will also serve to develop in the students an interest in the humanities and other fields not specifically covered in the M.I.T. curriculum. In line with this objective it is planned to house in the Library the departments in the social sciences and the humanities. Another important part of the Library will be an audiovisual center, in which will be available all sorts of recorded sound and visual devices such as motion-picture film. M.I.T.'s large collection of recorded music will also be housed in this modern center which will, in addition, provide a variety of facilities for instruction in modern languages and public speaking.

The Library will also serve as a graphic arts center and will contain adequate space for exhibits of arts and crafts. There will be a special map room, funds for which have already been provided by a group of alumni, and space will be provided for some of the Institute's special museum collections.

The Corporations' Visiting Committee on the Library, the Director of Libraries, John E. Burchard, the Librarian, William N. Seaver, the present library staff, the Faculty Committee on the Library, the architects, and many others have played a role in formulating plans for this great library. Under a grant from the Rockefeller Foundation the Institute itself has participated in an interuniversity project dealing with library construction. In his annual report President Compton states: "We have good reason to believe that in this projected library we are setting a new standard in university library housing and that the entire program reflects the judgment and foresight of the most experienced and forward-looking people in the library field."

About People

Glenn T. Seaborg, University of California, was the fifth speaker in the Wayne University chemical lecture series Monday evening, March 24. Dr. Seaborg, co-discoverer of plutonium and the transuranic elements, americium and curium, is a member of the 9-man general advisory committee appointed by President Truman to assist the Atomic Energy Commission (*Science*, December 20, 1946).

Raymond J. Seeger has been appointed chief physicist in charge of the Mechanics Division of the Research Department, the Naval Ordnance Laboratory, White Oak, Maryland, has announced. Principal facilities of the Division, engaged primarily in research in fluid dynamics, are supersonic wind tunnels which the Joint Chiefs of Staff transferred from the former Aerodynamics-Ballistics Research Institute at Kochelsee, Germany, to the Naval Ordnance Laboratory. The tunnels will be used partially for research in fundamental gas dynamics, including work in hypersonic flow. Special facilities provide for hydrodynamics research in water entry, initial trajectory, and underwater motion problems. Precision-firing ranges are planned for free-flight observations on aerodynamic models.

Dr. Seeger was research consultant in theoretical physics, Bureau of Ordnance, Navy Department, while on war leave from George Washington University's Department of Physics.

Stephen P. Timoshenko, professor emeritus of theoretical and applied mechanics, Stanford University, is en route to London to deliver a series of lectures at the invitation of the Institution of Mechanical Engineers. Following the lectures, which will be on "Stress Concentrations and Fatigue Failures," Dr. Timoshenko will travel to France, Switzerland, and Germany for consultations on progress in the field of theoretical and applied mechanics, returning to Stanford late in the summer.

A. Sidney Harris, associate professor of physiology at Western Reserve University School of Medicine, has been appointed associate professor of physiology at Baylor University College of Medicine, effective July 1. He will direct a teaching and research divisional unit in the Department of Physiology, embracing cardiovascular physiology and biophysics.

F. C. Henriques, Jr., recently of the Radiation Laboratory, University of California, Berkeley, has joined the staff of Tracerlab, Inc., Boston, Massachusetts. As director of the Radiochemical Division, he is in charge of Tracerlab's rapidly expanding chemical program and will supervise the development of apparatus and techniques for the purification, synthesis, and analysis of radioactive substances.

William H. Peterson, professor of biochemistry, University of Wisconsin, delivered the 7th Harvey Lecture of the current series at the New York Academy of Medicine on April 17. Dr. Peterson spoke on: "Factors Affecting the Kinds and Quantities of Penicillin Produced by Molds."

Visitors to U. S.

G. Malcolm Dyson, scientific director of a group of British chemical manufacturing companies, recently arrived in this country to attend the meeting of the American Chemical Society, at which he spoke on his new notation for organic compounds. Dr. Dyson has recently been made president of an international commission to report on ciphering and related subjects for the International Union of Chemistry.

Arne Tiselius, Uppsala University, chairman of the Swedish Natural Science Research Council, will leave soon for the U. S. to study the application of isotopes to medical and biological research. Per Ohlin and Sten von Friesen, Swedish scientists, will also visit the U. S. for

atomic studies in New York, Boston, and Chicago.

D. G. Catcheside, of Trinity College, Cambridge, England, will spend six months in the United States studying the genetics of the Mexican guayule plant. He will join the staff of the Stanford Research Institute, which has undertaken a $150,000 program on natural rubber for the Office of Naval Research. Dr. Catcheside, well known for his studies on the effects of ionizing radiation on hereditary characteristics, is a member of the British Ministry of Labor panel for industrial protection and radiation.

Fellowships

Massachusetts Institute of Technology has announced the availability of a limited number of research assistantships for fundamental research in the organic or physicochemical phases of carbohydrate chemistry. The fellowships have been provided by a grant from the Sugar Research Foundation, Inc., and the investigations must be conducted in the Foundation's laboratory of the Department of Chemistry.

Candidates must be outstanding graduates of accredited colleges and universities who possess a specific interest in the field and who are working toward the Ph.D. degree. They must also meet all requirements for admission to M.I.T.'s Graduate School. The annual stipend to the recipient amounts to $950 for 12 months, exclusive of tuition, which is provided. The appointments are available to candidates for admission at the beginning of the fall term and are ordinarily renewable for the number of years necessary for completion of requirements for the Ph.D., providing that the appointee maintains acceptable standards of performance.

Correspondence should be addressed to the Chairman, Department of Chemistry, Massachusetts Institute of Technology, Cambridge 39, Massachusetts, with specific indication that the candidate is interested in the organic or physicochemical aspects of the field, or both. Application blanks and other information will be forwarded on request.

Grants and Awards

The New York Zoological Society is offering four grants-in-aid of $500 each to qualified scientists for work in the Zoological Park in the Bronx during the summer season of 1947. In addition, appointees will be provided with simple but adequate living quarters. Emphasis will be placed on deviate or abnormal behavior and adjustments of zoological park animals.

The grants will be awarded to individuals who hold at least one advanced degree in the broad fields of the zoological sciences, including medicine, and who are capable of both independent and cooperative research. Special consideration will be given candidates who have advanced training and research experience in comparative psychology or who are medical students and anticipate professional work in psychiatry and/or neurology.

Applications should be made before May 15 to Fairfield Osborn, president of the New York Zoological Society, 630 Fifth Avenue, New York 20, New York.

The Committee on Fellowships and Awards of the American College of Physicians has granted research fellowships in medicine to the following for the year beginning July 1, 1947: Ward S. Fowler, Philadelphia, who will study pathological physiology of certain primary disorders under Julius H. Comroe, Jr., Graduate School of Medicine, University of Pennsylvania; Arnold Livingstone Johnson, Montreal, Canada, who will continue investigation of hemodynamics of congenital heart disease at Children's Memorial Hospital and the Department of Physiology, McGill University, under Alton Goldbloom and H. E. Hoff; Mary Ann Payne, assistant resident in medicine, New York Hospital, for study of hepatorenal factors in regard to shock and hypertension under David P. Barr and Ephraim Shorr; Miriam Mellon Pennoyer, St. Louis, Missouri, for an investigation of adrenal function in newborn and premature infants at St. Louis Children's Hospital under A. F. Hartmann, Washington University School of Medicine; and Philip Franklin Wagley, Baltimore, Maryland, who will study certain mechanisms of hemolysis at Boston City Hospital under William B. Castle and George R. Minot.

First award of a fellowship in this series went to Tom Fite Paine, Jr., Aberdeen, Mississippi (*Science*, January 3, 1947.)

William N. Lacey, professor of chemical engineering, California Institute of Technology, received the Anthony F. Lucas Gold Medal for 1947 at the 75th anniversary banquet of the American Institute of Mining and Metallurgical Engineers, New York City, March 19. Lacey received the award for "distinguished achievement in directing research in the fundamentals of hydrocarbon behavior and particularly application of these fundamentals to oil and gas reservoirs which have led to greater efficiency in oil and gas production from our fields."

Eloise Chute, formerly of the Dartmouth Eye Institute, has been awarded a research fellowship in clinical psychology at the University of Pittsburgh. She will investigate the relationship between the conceptual thinking of deteriorated senile patients and that of normal subjects of lower mental levels.

The Wildlife Society named "Predation and vertebrate populations," an article by Paul L. Errington, research associate professor of economic zoology, Iowa State College, the outstanding paper in wildlife ecology and management for 1946. The paper appeared in the *Quarterly Review of Biology* for June and September 1946. Dr. Errington, who is a participant in the program of the Iowa Cooperative Wildlife Research Unit, was similarly honored in 1941 (*Science*, April 11, 1941).

Burton E. Livingston, former director of the Laboratory of Plant Physiology, Johns Hopkins University, and recently retired from the Executive Committee of the AAAS, has been awarded the Stephen Hales Prize for 1946, according to an announcement by the American Society of Plant Physiologists in its journal, Plant Physiology.

The journal also reports that Edwin C. Miller, professor emeritus of plant physiology at Kansas State College, has been awarded the honorary Charles Reid Barnes Membership for 1946.

Patricia Dolciani, Cornell University, has been awarded the postdoctoral fellowship of Sigma Delta Epsilon, graduate women's scientific fraternity, for 1947–48. Miss Dolciani, candidate for the Ph.D. degree in mathematics in June 1947, has held the Allen Seymour Olmstead Fellowship at Cornell since 1945. She will continue her research on the integral representation of integers by quadratic forms in three or more variables at the School of Mathe-

matics, Institute for Advanced Study, Princeton.

Howard G. Swann, assistant professor of physiology, University of Texas Medical Branch, Galveston, has received a grant of $10,000 from the Army Research Program to continue studies on aviation physiology which he began during the war at Wright Field Aviation Physiology Laboratories.

The History of Science Society has established a History of Science Prize of $100, to be awarded annually to an undergraduate or first-year graduate student in a U. S. or Canadian college, university, or professional school for the outstanding original paper submitted on some aspect of the history of modern science.

Papers may deal with any of the natural sciences or mathematics, the fields of engineering or agriculture. It is preferred that essay subjects be selected from the period 1600–1915, and that completed essays be transmitted by members of the faculty of the students' institutions. Essays, not to exceed 6,000 words and preferably not more than 3,000 words, will be accepted until October 1.

All communications should be directed to the chairman of the prize committee, Henry Guerlac, professor of history of science, Cornell University, Ithaca, New York.

Colleges and Universities

George D. Stoddard, former vice-president of AAAS, will be installed as president of the University of Illinois May 15–16. Members of the Board of Trustees, faculty, alumni, and invited speakers will participate in ceremonies in Chicago and Urbana-Champaign.

Anton J. Carlson, emeritus professor of physiology, University of Chicago, and past president of AAAS, will speak at a noon luncheon in Chicago, May 15, following morning convocations at the University's Schools of Medicine, Dentistry, Pharmacy, and Nursing.

An afternoon meeting in Chicago will be addressed by President Stoddard; Andrew C. Ivy, vice-president for the University's Chicago professional colleges; and Charles Luckman, alumnus, and president of Lever Brothers. James B. Conant, president of Harvard University and chairman of the executive committee, AAAS, and Omar N. Bradley, U. S. Administrator of Veterans Affairs, will speak at an evening banquet.

At Urbana-Champaign on May 16 President Stoddard will speak at installation exercises in the morning, and the following will later participate in a symposium on higher education: Sir John Orr, Bucksburn, Scotland, member of the British Parliament, and director-general, United Nations Food and Agricultural Organization; Archibald MacLeish, U. S. representative on the executive board of UNESCO; and Robert M. Hutchins, chancellor, University of Chicago.

Stanford University has established an Eye Bank to provide corneal material for eye graft operations at Stanford University Hospital, San Francisco. All qualified eye surgeons on the Pacific Coast will be invited to make use of the Bank, which is being started on gift funds received by the University.

Anthony J. J. Rourke, superintendent of Stanford Hospital, will direct operations of the center. Full information on correct procedure for registration of donors may be obtained from Stanford Eye Bank, 2398 Sacramento Street, San Francisco.

The new 300,000,000-volt betatron being built at the University of Illinois will be 23 feet long, 13 feet high, and 6½ feet thick, compared with corresponding dimensions of 19 inches, 10 inches, and 8 inches for the 2,500,000-volt betatron invented and built at Illinois in 1940.

According to the University, the hollow "donut" vacuum tube in which electrons will be accelerated will be 9 feet in diameter in the new instrument, which will itself weigh more than 400 tons; the first weighed 200 pounds and had a vacuum tube of 8 inches. Electrons will travel 700 miles in the 1947 betatron compared with 60 miles in the 1940 model, and power consumption will be 150 kilowatts compared with 5 kilowatts.

The betatron was invented at Illinois in 1940 by Donald W. Kerst (*Science*, January 3, 1947). The 300,000,000-volt betatron will be the University's fourth. All will be housed in a new laboratory which is nearing completion on the campus.

The Physico-Chemical Institute, University of Uppsala, Sweden, has started construction of a $695,000 cyclotron laboratory financed jointly by industry and the Swedish Government.

The cyclotron, to be completed in 1948, will weigh 640 tons. It is hoped that it will attain energies of 60,000,000 electron volts for nuclei of heavy hydrogen and 120,000,000 volts for ordinary hydrogen nuclei. It will be used for medical and nuclear research by the Institute staff under The Svedberg, and by industry in investigating uses of radiation in production of textile materials and the chemical industry.

The laboratory will form the center of a science quarter to be built with a physical laboratory on one side and a chemical laboratory on the other, according to the Swedish-International Press Bureau, while a biochemical institute and a large institute for inorganic and organic chemistry will be built in the immediate neighborhood.

Another large cyclotron building is in progress at the Nobel Institute, Stockholm, which is under the direction of Manne Siegbahn.

A scroll commemorating the founding meeting of the American Medical Association at the New York University Medical Department in May 1846 was presented to Currier McEwen, dean of the University's College of Medicine, at the recent annual Alumni Day Dinner of the College in New York.

More than 250 alumni doctors of the College of Medicine attended the dinner and witnessed presentation of the scroll, which said: "In commemoration of the assistance and hospitality extended to the National Medical Convention, the first organizational meeting of the American Medical Association, held in May 1846, in the Hall of the Medical Department of the University then located at Broadway and Third Street, New York City, this scroll is presented to the College of Medicine of New York University on the occasion of Alumni Day, February 22, 1947."

The A.M.A. will hold centennial meetings in Atlantic City, June 9–13.

West Virginia University Agricultural Experiment Station announces publication of *Weeds of the world, their digestibility and composition*, by Burch H. Schneider, professor of animal husbandry. The work on which the technical reference book is based was conducted on request of the Committee on Animal Nutrition, National Research Council, with a grant-in-aid from Swift & Company, Chicago.

Northwestern University has developed a new testing machine to test artificial limbs for the country's 20,000 veterans and 65,000 war workers who have had amputations. The machine will make an artificial leg carrying a load of 300 pounds "walk" at the rate of 3,000,000 steps in 10 days, the equivalent of three years of normal wear.

The device was designed by William E. Dunshee, John F. Hopp, and LeRoy Barnes, research associates in mechanical engineering, under a Northwestern program of research in artificial limbs financed by the NRC Committee on Artificial Limbs. Paul E. Klopsteg, director of research, Northwestern University Technological Institute, is director of the NRC Committee.

The fatigue tester is used to study strength and durability of ankle and knee mechanisms, plastic shanks, and plastic cement. In one test of artificial leg fittings used at Army amputation centers a leg completed 7,190,000 steps, or three weeks of continuous high-speed walking, without failing. This is the equivalent of seven years of normal wear.

Preliminary tests indicate that a combination of riveting and bonding—plastic cementing—is the strongest means of connecting joints, and that plastic parts show great strength. No plastic part of any limb has failed to date in the fatigue testing machine.

Summer Programs

The University of Wisconsin in 1948 will discontinue its 16-week summer semester in favor of the regular 8-week session. The full summer session and continual year-round educational program was adopted during the war to speed training programs and was continued as an aid to returned veterans.

The Canadian Mathematical Congress will hold a Summer Seminar at the University of Toronto, August 15-September 14. U. S. mathematicians are invited to attend.

On the research level the Seminar will center on algebra and the theory of numbers. L. J. Mordell, Sadlerian professor of mathematics, Cambridge University, Saunders MacLane, Harvard University, and Paul Dubreil, University of Nancy, on appointment of their respective governments, will give series of lectures. A seminar on algebra under Richard Brauer, University of Toronto, and one on the theory of numbers under Gordon Pall, Illinois Institute of Technology, will integrate work of the general Seminar in these fields.

On the instructional plane there will be courses on the level of the Master's degree on subjects of the Seminar.

It is planned to accommodate mathematicians and their families in one of the residences of the University at a moderate rate. The Seminar fee is $10. Applications should be sent to The Secretariat, Canadian Mathematical Congress, Engineering Building, McGill University, Montreal, Quebec.

Inquiries regarding accommodation should be directed to the secretary of the local committee, G. deB. Robinson, Department of Mathematics, University of Toronto, Toronto, Canada.

Meetings

The Field Conference of Pennsylvania Geologists will be held at Lehigh University, Bethlehem, Pennsylvania, May 30–31 and June 1. Field trips will be held in and near the Lehigh Valley. Information may be obtained from the secretary of the Conference, M. N. Shaffner, Pennsylvania Topographic and Geologic Survey, Harrisburg, or Bradford Willard, head, Department of Geology, Lehigh University, Bethlehem.

The Institute of Food Technologists will meet June 1–4 at the Hotel Statler, Boston, Massachusetts. Among the scheduled features are an evening symposium on "Potential Applications of Colloidal Chemistry and Food Processing," led by Ernst Hauser; sessions on "Food Technology and Its Relation to Management," "Research and Development Administration," "Food Transportation and Storage," and "Food Processing and Sanitation"; seminar sessions on "Frozen Foods" and "Fisheries Technology"; and presentation of the Industry Achievement Award and the Nicholas Appert Medal Award.

Those interested in attending the conference are invited to address Robert J. Gray, Northeast Section, Institute of Food Technologists, % of Dewey and Almy Chemical Company, Cambridge, Massachusetts.

The Meteoritical Society will hold its 10th meeting in connection with the meeting of the Pacific Division of the AAAS in San Diego, California, June 18–19. The afternoon session of June 19 will be a joint session with the Astronomical Society of the Pacific.

Titles and abstracts of papers to be presented at the meeting should be sent to the chairman of the program committee, John A. Russell, Department of Astronomy, University of Southern California, Los Angeles 7, California.

The American Society for the Study of Blood will hold an organizational meeting at the Hotel Claridge, Atlantic City, New Jersey, Sunday, June 8. Information about the new society to promote study of diseases of the blood, blood grouping, and transfusions may be obtained from Alexander S. Wiener, M.D., 64 Rutland Road, Brooklyn 25, New York.

The Ohio Academy of Science will hold its 56th annual meeting at Marietta College, Marietta, Ohio, on May 1-3. Officers of the Academy are: H. H. M. Bowman, University of Toledo, president; W. M. Tidd, Ohio State University, treasurer; and Rush Elliott, Ohio University, secretary.

The New England Section of the American Society of Plant Physiologists will meet at the University of Vermont, Burlington, on May 23–24. Papers will be presented at the Friday afternoon and Saturday morning sessions, and a banquet is scheduled for Friday evening. All plant scientists are invited to make reservations through Dr. James W. Marvin, Department of Botany, University of Vermont.

The American Institute of Electrical Engineers has scheduled the following meetings for the remainder of 1947: Summer General Meeting, Montreal, Quebec, June 9–13; Pacific General Meeting, San Diego, California, August 26-29; Middle Eastern District Meeting, Dayton, Ohio, September 23–25; and Midwest General Meeting, Chicago, Illinois, November 3–7.

Recent Deaths

Sir Joseph Barcroft, 74, British physiologist, died March 21 in London. He was elected a Fellow of the Royal Society in 1910, president of the physiological section of the British Association in 1920, and was Fullerian professor of physiology at the Royal Institution from 1923 to 1926, after which he became professor of physiology at Cambridge.

Marion Savage, 61, a consulting engineer for the General Electric Company, who won the Lamme Gold Medal in 1938 for his work on large, high-speed turbine generators, died April 9 in Walterboro, South Carolina.

Walter **Ramsden,** 79, senior fellow of Pembroke College, Oxford, and emeritus Johnston professor of biochemistry at the University of Liverpool, died March 26 at Oxford.

Charles **A. Cadwell,** 76, former professor of mining engineering at Case School of Applied Science and for the last 36 years engaged in research in electricity and metallurgy for the Electric Railway Improvement Company, died March 27 in Cleveland, Ohio.

NRC News

Raymund L. Zwemer has recently been appointed executive secretary of the National Research Council and acting executive secretary of the National Academy of Sciences. For 16 years Dr. Zwemer was active in teaching and research at the College of Physicians and Surgeons, Columbia University, and for the past three years has been with the Department of State as executive director of the Interdepartmental Committee on Scientific and Cultural Cooperation.

The medical advisory committees of the Division of Medical Sciences have held a series of meetings since the first of the year to review problems in medicine, surgery, neuropsychiatry, and other specialized fields. These committees, which serve as a connecting link between the civilian medical profession and the Federal medical departments, are composed largely of outstanding specialists who served in the medical departments of the Army and Navy or contributed in a civilian capacity to work of the armed forces. Among recent problems upon which the committees have advised the Federal medical services are: use of oral penicillin in venereal disease prophylaxis, auditory standards for admission to the U. S. Military Academy, continuation of research on rheumatic fever, use of anesthetic ointments in the eye, and revision of physical standards for the Army and Navy. The latter undertaking will be continued over a period of years, during which currently applied physical and mental standards will be analyzed in the light of latest medical thought and practice. Since future emergencies will probably demand total utilization of man power, studies will be made concerning the use of the physically handicapped in military and civilian jobs. Experience in World War II demonstrated that many physically disqualified individuals can render effective service if properly assigned. In the revised physical standards, provisions will be made whereby physical and mental disabilities will be evaluated in relation to job placement.

A letter from Bruno Schussnig, Austrian phycologist, indicating the conditions under which he must work, has been received by Lewis Hanford Tiffany, Department of Botany, Northwestern University. Excerpts from the letter follow:

"Due to difficult conditions in Austria both for working and for living, I should appreciate an opportunity of continuing my work in some American university. I beg of you to keep my circumstance in mind and to let me know if any opportunity should arise for me to come to America.

"I shall appreciate any publications you and your fellow botanists can send me, for both my laboratory and my library of about 4,000 volumes in Vienna were completely destroyed by the Nazis. With these publications it will be possible for me to continue my researches. I am hoping to complete my 3-volume treatise on the lower plants. The first volume appeared in 1938 and is to be revised. The second volume will treat of the colonization, sexuality and inheritance among the lower plants, and the third will propose a new classification of these plants."

Professor Schussnig's address is Igls bei Innsbruck, Osterreich, Europa.

Williams & Wilkins Company, scientific publishers, Baltimore, Maryland, announce appointment to the editorial staff of F. Kenneth Albrecht, until recently medical adviser to the U. S. Consulate and immigration authorities in Berlin.

Cinchona Products Institute, Inc., New York, celebrated its 10th anniversary in New York, March 10. The Institute has sponsored research on the pharmacology and therapeutics of the cinchona alkaloids, as well as the physiology and genetics of the genus *Cinchona*, grants having been made to Cornell University, Johns Hopkins University, Princeton, Chicago University, University of North Carolina, New York University, as well as to individuals and state departments of health. Robert H. deGreeff and Norman Taylor have been president and director, respectively, since establishment of the Institute.

The Kaiser Wilhelm-Institut für Biologie, formerly of Berlin-Dahlem, is now located at Silikatforschung, Faradayweg, but a new central building will soon be built in Tübingen, in the French zone of Germany. K. Paetau is temporarily in charge at Dahlem, where little remains of the original institute. E. Stein, M. v. Dehn, and J. Hassinger-Huizinga are still at Dahlem.

Institut de Recherches sur le Cancer, Lille, France, wishes to exchange periodicals and reprints with U. S. organizations conducting cancer research. Communications may be directed to J. Driessens, Directeur de l'Institut de Recherches sur le Cancer, Cité Hospitalière, Lille, France.

The John Beard Memorial Foundation, a nonprofit organization to investigate problems requiring correlation of biology, chemistry, and the medical sciences, has been established at 642 Capp Street, San Francisco, California. The research program has begun with studies on metagenesis and the trophoblastic character of cancer.

Preliminary steps to establish a new South Pacific Commission were taken February 6 when representatives of the participating governments of Australia, France, Netherlands, New Zealand, United Kingdom, and the United States met at Canberra. The object of the Commission is to promote international cooperation in the development of economic and social welfare of the peoples of the non-self-governing territories in the South Pacific region. All of the governments administer territories south of the equator and east from, and including, Netherlands New Guinea. The Commission is to be a

consultative and advisory body, organized to study, formulate, and recommend measures for improving agriculture, animal husbandry, communications, transportation, fisheries, forestry, industry, labor marketing, production, trade and finance, public works, education, health, housing, and social welfare within the territory designated. Each of the participating governments is to appoint two commissioners, who will be required to hold at least two regular sessions per year.

One of the important instruments of the Commission is a research council, which is to be established as a standing body to advise the Commission. It is expected that a small number of qualified full-time workers to help in economic and social research will be appointed immediately. In these activities, provision is made for participation of the local inhabitants.

The Commission has no organic connection with the United Nations, but expects to cooperate as fully as possible from its temporary headquarters at Sydney, where preliminary arrangements for the establishment will be undertaken jointly by the Australian and New Zealand governments.

An initial budget of 40,000 pounds sterling has been provided, which, after ratification by the cooperating governments, will be increased, with Australia carrying almost one-third of the total budget.

Make Plans for—

New York State Geological Association, 19th field meeting, May 9–10, New York City.

Federation of American Societies for Experimental Biology, May 18–22 **Chicago, Illinois.**

Medical Library Association, 46th annual meeting, May 27–29, Cleveland, Ohio.

American Medical Association, centennial session, June 9–13, Atlantic City, New Jersey.

Pacific Division, AAAS, 28th annual meeting, June 16–21, San Diego, California.

COMMENTS
by Readers

As the effectiveness of DDT residual house spraying against *Anopheles albimanus* is a problem of great practical importance for malaria control in the Caribbean area, the work of Stephens and Pratt in Puerto Rico (*Science*, January 10, p. 32) should be examined in the light of the experience with this species in Panamá (*Amer. J. trop. Med.*, 1946, **26,** 383), particularly since Stephens and Pratt have overlooked certain basic considerations.

They report that no reduction of *A. albimanus* occurred, a conclusion based solely on bait and light trap catches. On the basis of the Panamá work, bait trap catches alone are not a valid index of the effectiveness of house spraying. Sharp reductions occur, but persist for only two to six weeks after spraying. This transient effect appears not only in the village but also for some distance around it. *A. albimanus* rests in houses during the night, and counts may be made then. Night catches in treated houses in Panamá show the following prolonged effects: (a) great reduction in numbers of anophelines; (b) reduction in the proportion of engorged anophelines; (c) low 24-hour survival rate for engorged anophelines.

These phenomena, of direct significance in terms of the malaria-transmission potential, occur in close association with the sprayed surfaces, namely, in the houses, and are best measured in houses.

Stephens and Pratt compare their bait and light trap catches of *A. albimanus* with house observations of *A. quadrimaculatus* in Arkansas, and *A. pseudopunctipennis* in Mexico, where marked reductions occurred. This is not a valid comparison. House catches of *A. albimanus* in Panamá show results comparable with those obtained with *A. quadrimaculatus* and *A. pseudopunctipennis*. While it is possible, or indeed quite likely, that the mosquitoes of the Puerto Rican houses were similarly affected, the recorded observations are inadequate to show what happened.

The lower malaria rate reported for the treated Puerto Rican village, after one year, may or may not be significant, but in view of the well-known annual fluctuations of malaria, even in adjacent villages and independent of any control measures, judgment should be suspended. (HAROLD TRAPIDO, *Gorgas Memorial Laboratory, Panamá, Republic de Panamá.*)

Bluhm's suggestion that the excess of male births above the theoretical ratio of 50 per cent can be explained by the lighter mass of androsperms (bearing the Y chromosome) in comparison with gynosperms (bearing the X chromosomes) has been criticized recently by Leonard Walker (*Science*, March 7, p. 262). Without necessarily subscribing to Bluhm's theory, I should like to point out a rather obvious fallacy in Walker's argument.

The entire demonstration hinges on the equation: $\frac{v_y}{v_x} = \frac{106}{100}$, in which Walker assumes that the ratio of the velocities of the androsperms and gynosperms is *equal* to the sex ratio. He offers no evidence to support this assumption, and there is every reason to believe that the relationship is by no means so simple.

It seems obvious that the relative velocity of the two kinds of sperms is not the only factor influencing the sex ratio. Also involved are the distance the sperms have to travel, their starting points, and the numbers of each kind of sperm entering the contest, as well as many other factors. If only one sperm of each sort were involved, it is easy to see how the slower sperm might win out, if the faster one, like the hare, stopped on the way; or, in fact, most likely neither sperm would reach the destination. But with 200,000,000 of each kind of sperm in the race, and with only a single victor, any significant advantage for the androsperms would practically guarantee that the winner would be one of the androsperms. Thus, it seems obvious that the difference in velocities of the two sorts of sperms must be much smaller than assumed by the equation given above, because otherwise only males would be born. (ALEXANDER S. WIENER, *64 Rutland Road, Brooklyn, New York.*)

TECHNICAL PAPERS

The Cytological Effects of Podophyllin

B. J. SULLIVAN and H. I. WECHSLER

Biological Laboratory, Fordham University, New York City

A recent report by L. S. King and M. Sullivan (*1*) compared the similarity of the effects of podophyllin and colchicine and their use in the treatment of condylomata acuminata. Histological examination revealed an alteration of nuclear pattern and "colchicine figures." A study of the cytological effects of podophyllin was thus suggested. This investigation was made on the meristematic tissue of root tips of *Allium Cepa*, and the preliminary observations are reported here.

The British *Pharmacopeia* recognizes podophyllin as the resin of *Podophyllum*, a mixture of resins obtained from either of two plants, American *Podophyllum* or Indian *Podophyllum*. The *National Formulary* resin is obtained only from the former. The rhizomes of the plant yield from 3 to 10 per cent of resin consisting of podophyllotoxin, $C_{22}H_{22}O_8$, and small amounts of resin glycosides, resenes, starch, gum, etc. The resin is an amorphous powder varying in color from light brown to greenish yellow, turning darker when exposed to temperature exceeding 25° C. or to light. The resin of *Podophyllum* is slightly soluble in ether or chloroform and is soluble in alcohol, with only a slight opalescence. It is slightly soluble in water and gives a light brown color to the solution. This may be due only to the dissolving of the coloring factor, quercitin, found in the resin.

Merck's *Index* reports that the resin contains picropodophyllin, quercitin, podophylloresin, and podophyllotoxin. It is claimed that the latter ingredient is the active principle. The therapeutic and pharmaceutical activity of the drug is due to this principle, but its cytological effects may be due to an entirely different one. Preliminary experiments with saturated aqueous solutions indicate that the cytological effects are due to a substance in solution. Uniform results were achieved, however, using not only saturated solutions but also the filtrates of such solutions and those from which the color had been removed. Further experiments are being conducted to determine just which of the constituents of the resin produce the cytological changes.

Young growing root tips of *Allium Cepa* were immersed in a saturated aqueous solution of podophyllin, and maximal results were produced in two hours. Typical resting stage and prophase figures were observed in smear preparations. Pronounced cytological effects were produced in late prophase, and the spindle mechanism was evidently impaired, since no orientation of the chromosomes on the metaphase plate was observed. The chromosomes were dispersed in the cell. In this respect podophyllin is comparable to colchicine, to which the inhibition of spindle formation is attributed.

Metaphase chromosomes were in the form of typical diplochromosomes; sister chromatids held together at the spindle attachment region, with slightly contracted arms which have become disengaged from the relational coil.

A notable effect brought about through the use of podophyllin is the increase in the number of mitotic figures up to metaphase, and the decrease and, later, complete absence of anaphase and telophase figures.

Podophyllin has properties which make it useful in cytological research. Toxicity to the cell is negligible except in prolonged treatments involving agitated suspensions. The chromosomes disperse in a typical smear to the extent that counts may be made easily. Because of its similarity to colchicine, podophyllin may prove to be valuable in the role played by colchicine in cytological research.

Podophyllin is readily available at pharmaceutical supply houses and may be obtained at approximately $.90 for four ounces.

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The Phosphorescence of Chlorophyll and Some Chlorin Derivatives

M. CALVIN and G. D. DOROUGH

Department of Chemistry, University of California, Berkeley

In the course of our studies on the photochemistry of zinc tetraphenylchlorin (*1*), it appeared necessary to postulate a long-lived excited state of the chlorin. In order to determine whether this and similar molecules were capable of existing in such a metastable state, an experiment was designed to observe the phosphorescence which would be admitted when the molecule passed from this metastable excited state back to the ground state. The conditions most favorable for the observation of this phenomenon were established (*3*) and observations made on three compounds: zinc tetraphenylchlorin, copper tetraphenylchlorin, and a purified mixture of chlorophylls *a* and *b*.[1]

The zinc chlorin and the chlorophyll showed phosphorescent bands commencing in the range of 7,800–8,000 A. and extending into the infrared. The lifetime of the phosphorescent state of these two is estimated in the region of 0.2 second. No phosphorescence could be observed for the copper chlorin on the phosphoroscope used, which fact puts an upper limit to the life of a metastable state for this substance at around 10^{-5} second, if such a metastable state exists at all.

Accepting the interpretation that these metastable states are triplet states whose life is prolonged by the triplet-singlet selection rule prohibition (*2, 3*), the failure of the copper salt

[1] This sample of chlorophyll was kindly supplied to us by Prof. G. Mackinney. Other derivatives of tetraphenylchlorin and tetraphenylporphyrin were also examined, and the results will be reported elsewhere.

to exhibit phosphorescence can be understood as being due to the breakdown of this selection rule by the inhomogeneous magnetic field produced within the molecule by the paramagnetic moment of the copper. This result was also predicted from the experimental observation that the copper chlorin is not at all comparable in photochemical activity with the zinc salt, although the two compounds are otherwise very similar, especially in absorption spectrum (*1*).

The significance of this observation of the phosphorescence of chlorophyll with respect to the mechanism of photosynthesis will be discussed in detail elsewhere.

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Rate of Vaporization of Sulfur

F. M. Turrell

University of California Citrus Experiment Station, Riverside

The rate of vaporization of elemental sulfur at different air temperatures has been studied by various investigators, including Goodwin and Martin (*3*), Tucker (*6*), Liming (*5*), Turrell (*7*), Fouretier and Boullé (*1*), and others. Such information is of particular interest in agriculture because there appears to be a correlation between rate of vaporization, fineness of sulfur particles, and insecticidal and fungicidal effectiveness. Although some of these data have been summarized in recent books (*2*, *4*), it apparently has not been recognized that the rate of vaporization (sublimation) of elemental sulfur is a logarithmic function of temperature.

Experimental data obtained by the observers named above, as determined by several different methods on various kinds of sulfur from widely different sources, are plotted on a semilogarithmic grid in Fig. 1. The linear curves illustrate the logarithmic relations between rate of vaporization and temperature and may be expressed by a logarithmic equation of the form $\log Y = \log a + X \log b$ or in normal form by the equation $Y = ab^x$.

When compared, slopes of the two curves based on relative vaporization rates are not the same nor are the two curve slopes based on absolute vaporization rates. From the magnitude of the deviations of the points from the curves, it may be surmised that sufficient observations have not been made to define the curve slopes critically. The magnitude of the deviations suggests that with sufficient precision in the determinations, or with larger numbers of observations, curves of the same slope might be found for the various sulfurs used. Juxtaposition of the curves based on Liming's relative values and on Tucker's absolute values may be obtained if the two are adjusted to a single absolute observation. Tucker's values seem unreasonably high, however. Also, the composite curve based on the absolute vaporization rates of ground sulfur, as determined by Turrell (*7*) and by Fouretier and Boullé (*1*), nearly parallels the curve based on the relative values found by Goodwin and Martin (*3*). Comparison of the positions of the curves based on absolute rates suggests that sulfur from different sources may vary in the rate of evaporation at a given temperature. Some of the more obvious causes for this appear to be: (*a*) impurities, such as oil; (*b*) differences in particle size; (*c*) form; and (*d*) technique used in making the determination.

The logarithmic characteristics of the vaporization process at

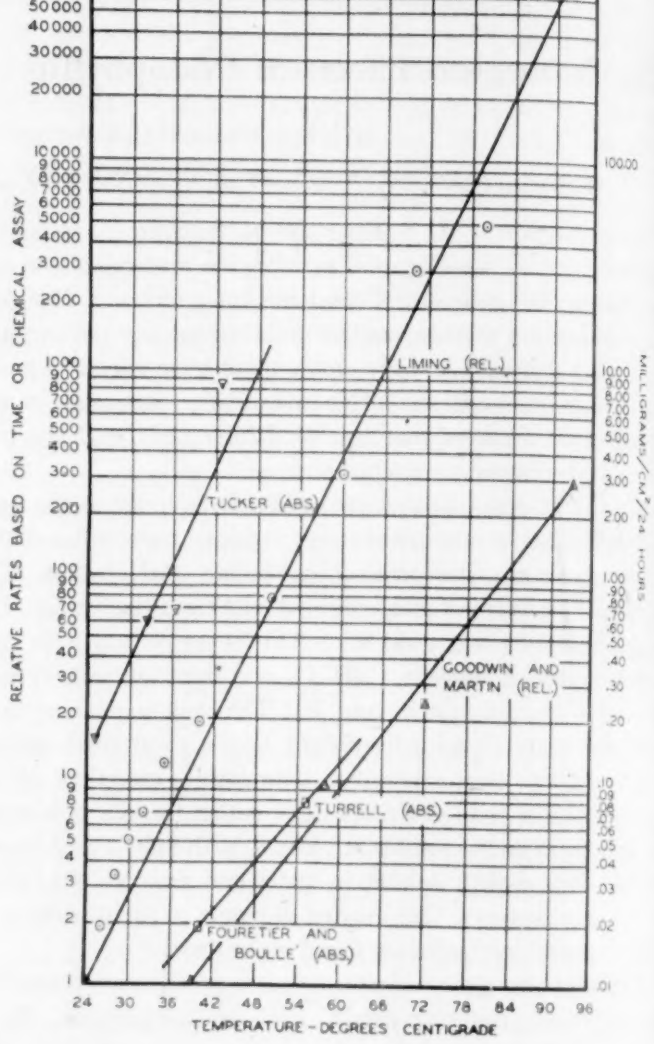

Fig. 1. Relative and absolute rates of volatilization of elemental sulfur, based on data of various observers, showing logarithmic increase of volatilization rate with increase in temperature.

different air temperatures suggest that the rate of vaporization of sulfur of varying particle sizes and from various sources may be determined readily, and that recommendations may be formulated for use in warm as well as cool seasons and climates. Adequate pest control, and reduction of loss of agricultural crops as a result of "sulfur burn," may thus be attained by recommending sulfurs having specified evaporation rates.

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Effect of Streptomycin on the Metabolism of Certain Mycobacteria

FREDERICK BERNHEIM and R. J. FITZGERALD

Department of Physiology and Pharmacology, Duke University School of Medicine, Durham, North Carolina

A nonpathogenic strain of tubercle bacillus, No. 607 of the American Type Culture Collection, rapidly oxidizes benzoic acid. The hydroxybenzoic acids, however, are not oxidized. This confirms Lehmann's observation (*2*) that the oxygen uptake of nonpathogenic strains is not affected by hydroxybenzoic acids, whereas that of pathogenic strains, as previously shown (*1*), is definitely increased by o-hydroxybenzoic acid as well as benzoic acid. The evidence indicates, however, that although the pathogenic strains of tubercle bacillus have an increased oxygen uptake in the presence of benzoic and o-hydroxybenzoic acids, these compounds are not oxidized in the process. Because of the apparent importance of benzoic acids in the metabolism of these bacteria, it was of interest to study the effect of streptomycin on it.

Resistance to streptomycin was induced in *Myco. tuberculosis* No. 607 by successive passage in Long's medium containing increasingly higher concentrations of the drug. Suspensions of the resistant strain and the normal parent strain were prepared from 3-day cultures on Long's medium by the method previously described (*1*). The bacteria were resuspended in M/20 phosphate buffer pH 6.7 so that 1.0 cc. of buffer contained 0.1 cc. of the packed centrifuged organisms,

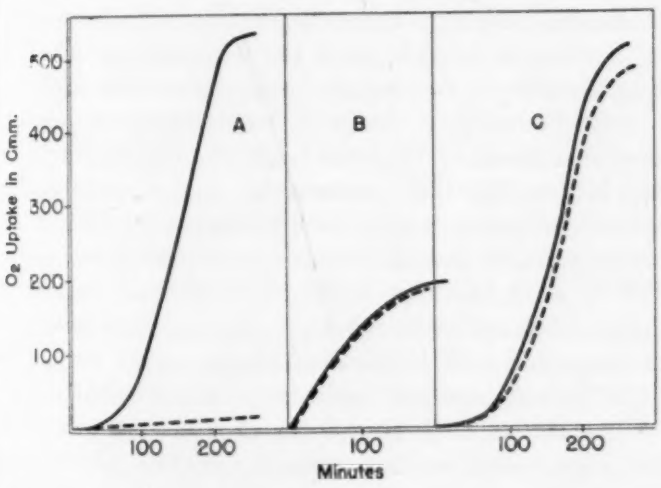

FIG. 1. A—Effect of 10 γ streptomycin on the oxidation of 1.0 mg. sodium benzoate by the normal 607 strain; B—Effect of 100 γ streptomycin on the oxidation of 2.0 mg. sodium pyruvate by the normal 607 strain; C—Effect of 100 γ streptomycin on the oxidation of 1.0 mg. sodium benzoate by the streptomycin-resistant 607 strain. The control uptakes have been subtracted. The dotted lines represent the addition of streptomycin.

and 0.5 cc. of this suspension was used in each Warburg vessel, which contained a final volume of 2.0 cc.

Ten γ of streptomycin (Merck) completely inhibits the oxidation of 1.0 mg. of benzoic acid by the normal strain, whereas 100 γ is without effect on the oxidation by the resistant strain. The oxidation of pyruvic acid by the normal strain as well as its oxygen uptake without added substrate is not affected by 100 γ of streptomycin. This indicates that the inhibition of the benzoic acid oxidation by streptomycin may be fairly specific. The results are shown in Fig. 1. However, the increased oxygen uptake of the virulent H37 strain in the presence of benzoic acid is not affected by 300 γ of streptomycin. Other mechanisms must, therefore, be inhibited in this pathogenic strain.

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Suppression of Axillary Growth in Decapitated Tobacco Plants by Chemicals

ROBERT A. STEINBERG

U. S. Department of Agriculture, Plant Industry Station, Beltsville, Maryland

In the commercial production of tobacco the plant is topped or decapitated at the flowering stage and later "suckered," *i.e.* at intervals all subsequent axillary growth is removed. An inexpensive substitute for the operation of suckering without detriment to quality or yield would be of practical importance to growers.

It was with this final objective in mind that greenhouse trials were begun on suppression of axillary growth of topped plants. The chemical compounds employed included certain synthetic growth-regulating substances, some of which have been reported to possess the ability of retarding axillary growth. Powdered compounds were applied to the stem wound with a spatula after topping, and liquid compounds with a dropper. Decapitated plants retained 7 leaves at the time of treatment. The plants were harvested 35 days after treatment

TABLE 1

Treatment	Green moist weight				
	Leaf		Stem	Suckers	Total (grams)
	(grams)	(%)	(grams)		
Control 1, suckered	145.6	100.0	55.8	46.2	247.6
Control 1, unsuckered	114.7	78.6	52.7	132.3	299.7
Control 2, suckered	146.3	100.0	45.3	63.9	255.5
Control 2, unsuckered	140.1	96.0	53.7	145.9	339.7
γ-(Indole-3)-n-butyric acid	162.4	111.2	56.9	111.8	326.1
4-Chlorophenoxyacetic acid*	168.0	115.1	55.3	180.3	403.6
α-2-Chlorophenoxypropionic acid*	174.7	119.7	59.5	156.6	390.8
α-Naphthylacetic acid methyl ester*	165.8	113.6	68.2	0	234.0
2,4-Dichlorophenoxyacetic acid methyl ester*	175.2	120.0	78.0	72.0	325.2

*Courtesy of the Dow Chemical Company.

A few of the responses are given in Table 1. The figures, which are average values for three plants in grams of fresh weight, clearly indicate the possibility of controlling the relative development of the various parts of the tobacco plant.

The responses fall into several categories. In one, chemical suppression of axillary growth is accomplished in a degree equal to manual suckering, with as great or greater increase in yield of leaf. In another category, the yields of leaf, stem, and suckers are all increased considerably above those of the

controls—apparently a stimulation response. Fuller details of the work will appear elsewhere.

These data indicate the possibility that it may be economically feasible to employ chemical suppression of suckers in the production of tobacco. However, experimental field work with these compounds under the actual conditions employed in the production of the different types of tobacco must be undertaken before their use can be recommended for this purpose. Such work is now under way with Maryland tobacco and with Rustica tobacco grown for nicotine.

Crystalline Kitol[1]

F. B. Clough, H. M. Kascher,
C. D. Robeson, and J. G. Baxter

Research Division, Distillation Products, Inc., Rochester, New York

Kitol has the interesting property of decomposing at elevated temperatures into vitamin A (*1*). This, and the possibility that it acts physiologically in inverse fashion to detoxify excessively high stores of vitamin A, has stimulated research to determine its structure. As a preliminary step we have prepared kitol in crystalline form and also its di-p-phenylazobenzoate ester.

The concentration procedure was different at certain stages from that previously described (*1*) and appeared to give a concentrate of slightly higher potency. Whale-liver oil (0.8 per cent kitol, 21,000 units of vitamin A/gram) was saponified, and the unsaponifiable matter was freed of sterols and other solids as far as possible by low-temperature crystallization from acetone. The resulting oil was mixed with constant-yield oil and residue oil (*2*) and distilled in a molecular still. A fraction rich in kitol was collected at 190–260°. This was stripped at 160°, after the addition of constant-yield oil and residue oil, to give a distilland rich in kitol and largely free of vitamin A. The unsaponifiable matter from the distilland was esterified with succinic anhydride; the acid succinate was neutralized in 83 per cent ethanol; and nonhydroxylic materials were separated by extraction with petroleum ether. By saponification a kitol concentrate [$E^{1\%}_{1\,cm.}$ (290 mμ) = 586] was obtained which was sufficiently pure so that a crystalline di-p-phenylazobenzoate ester could be prepared. We were unsuccessful in preparing a crystalline 3,5-dinitrobenzoate, as described by Embree and Shantz, probably because of the nature of the impurities present.

Crystallization of the unsaponifiable matter from the phenylazobenzoate from methyl alcohol gave kitol in the form of colorless, elongated prisms. The yield was approximately 10 per cent, based on the amount present in the original whale-liver oil. Direct crystallization of the kitol concentrate, even after its extinction coefficient had been raised to 650 by chromatography, gave only a poor yield of crystals. This behavior may indicate the presence of geometric isomers.

Kitol melted at 88–90° (capillary tube method—CT; 95–97° in the Fisher-Johns apparatus—FJ), and $E^{1\%}_{1\,cm.}$ (290 mμ) = 707. The analysis agreed with the formula $C_{40}H_{58}(OH)_2$, twice that of vitamin A. The crystals exhibited considerable stability toward atmospheric oxidation, for their ultraviolet absorption curve was unchanged after 53 hours exposure at room temperature in the dark. Kitol is more stable in air than vitamin A. In diffused daylight, however, only 44 per cent of the initial extinction coefficient was recovered in 46 hours. A solution of kitol in ethanol was relatively stable, losing only 7 per cent of its initial extinction coefficient after storage for 10 days in the dark at room temperature.

By distillation of kitol palmitate [$E^{1\%}_{1\,cm.}$ (290 mμ) = 379] in a cyclic molecular still (from peanut oil residue; temperature, 240–270°; pressure, 3μ), values of 0.67 and 0.75 were found for the moles of vitamin A palmitate collected in the distillate per mole of kitol palmitate destroyed. Similar results were obtained by heating refined cottonseed-oil solutions of kitol and its acetate in sealed tubes, but less reliance could be placed on these data, since the vitamin A formed during decomposition was not removed from the heating zone and a correction of uncertain accuracy had to be made for this source of error. The data suggest that the breakdown of kitol by heat is not a clean-cut process in which one molecule of vitamin A and another fragment of unknown composition is formed. It appears more probable that a number of degradative changes occur, with vitamin A constituting one of the major products formed.

Kitol diphenylazobenzoate was found to exist in two forms. One melted at 125–126° (CT) and was obtained by chromatographing the crude ester on silicic acid, followed by crystallization from methyl acetate. A higher melting form [m.p., 149–150° (CT), 153–155° (FJ)] was isolated by chromatographing the crude ester on zinc carbonate, followed by crystallization from acetone. Refluxing the higher melting ester in acetone, chromatographing it on sodium aluminum silicate, or treating it with iodine in benzene, gave the lower-melting ester, but the conversion was not usually quantitative. The high- and low-melting forms gave colorless hydrazo compounds which appeared to be the same. They had nearly the same melting point (124–126° and 127–129°, respectively), and a mixed melting point determination showed no depression [127–129° (CT)]. It seems probable that the two azoates are geometric isomers of the carbon-carbon type, although the data on the hydrazo compound does not exclude nitrogen-nitrogen stereoisomerism.

A crystalline anthraquinone carboxylate ester [m.p., 195–197° (CT)] was prepared, but this proved to be less suitable for concentrating kitol. It also appeared to exist in a lower-melting form which was not obtained pure. The palmitate and dinitrophthalate esters were prepared but could not be crystallized.

Whale-liver oil is not unique in containing kitol. The substance was found also in dogfish-liver oil (0.06 per cent) and in shark-liver oil (0.8 per cent). The oils were conveniently assayed by chromatographing the unsaponifiable matter on sodium aluminum silicate. Kitol is adsorbed more strongly than vitamin A alcohol and a relatively sharp separation could be effected by inspection of the column with ultraviolet light. The purity of the kitol fraction was then estimated by its extinction coefficient at 290 mμ, using the value of 700 for the pure material. This procedure is recommended for the assay of kitol in fish-liver oils.

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[1] Communication No. 111.

IN THE LABORATORY

Production of Quantitative Infections With the Filariae of the Cotton Rat[1]

J. ALLEN SCOTT

The University of Texas Medical Branch, Galveston

Progress in the study of filariasis has long been retarded by the lack of an animal that can be infected in the laboratory. A step forward was made last year with the production of mass infections with *Litomosoides carinii*, the filaria of the cotton rat. Experiments recently completed in this laboratory have shown that it is now possible to produce quantitative infections with these worms, *i.e.* infections made with a known number of larvae and thus limited to a definite maximum size. This step opens the way for a new approach to the study of filariasis. In chemotherapeutic studies parallel series of treated and control animals infected with an approximately equal number of worms, all of which are of the same age, make possible more accurate determinations than with the wild-caught or mass-infected animals previously used. Moreover, the susceptibility of various species of animals, the possibility of a changing susceptibility with advancing age, and other phases of the immune response can now be studied by this method.

The details of the method are simple. Tropical rat mites, *Liponyssus bacoti* are raised on a white rat in a metal tank surrounded by an oil-filled moat. After three or four weeks an initial 50 mites will have produced a large colony, and an infected cotton rat is then substituted for the white rat. Ten days later this rat is removed, and in a few days the mites begin to migrate up the sides of the container. They are transferred by suction to vials, in which they are held until at least two weeks after their first opportunity for an infected blood meal. They are then examined in saline under a cover glass, and those containing larvae are placed in separate bottles. When a sufficient number is available, each mite is held in a drop of saline under a dissecting microscope by laying the tip of a bent needle across the thorax, and the tip of the abdomen is removed with a knife-edged needle. The viscera are expressed through this opening and the larvae teased free in the saline. These are transferred with a fine pipette to a drop of saline in the "hookworm larva counting slide" designed by the writer and listed by Arthur H. Thomas Company. In this slide the larvae can be easily counted as they accumulate from successive dissections. When sufficient are present, they are drawn from the slide into a #15 hypodermic needle, 3½ inches long. Care is taken not to draw them through the needle into the attached tuberculin syringe, but the syringe contains saline to rinse the larvae out of the needle when the injection is given under the skin of the back. A check against loss is made by again rinsing the needle into the slide.

[1] Supported by a grant from the John and Mary R. Markle Foundation.

A Simple Method for Administering Nebulized Penicillin

DAVID GLUSKER

Tigris 42, Mexico, D. F.

Increasing recognition of the advantages of the inhalation treatment with penicillin vapor has led to the development of many complicated devices. This communication is to suggest a simple apparatus for nebulizing and administering penicillin.

Advantage has been taken of the fact that the De Vilbiss nebulizer #40 has an aperture which exactly fits the BLB "oxygen mask" type A-8-A arctic, manufactured by the Ohio Chemical Manufacturing Company. The mask's rebreathing bag and its side arm are removed, and the glass nebulizer is inserted into the tube leading to the mask. The lower end of the nebulizer is connected to a source of compressed air or oxygen. A T-tube is inserted in the compressed air line so that the patient can control the pressure in the system. This is done by closing the T-tube with the finger, on inspiration, and removing it during expiration. Using a flow of 6 or 7 l. of oxygen/minute, or its equivalent in compressed air, results in nebulization of watery penicillin solutions which are then inhaled via the mask through the nose or mouth with complete comfort to the patient. The simplicity and availability of this apparatus make the administration of penicillin vapor convenient and foolproof.

An Interphase Analyzer of the Electroencephalogram[1]

HARRY SONNEMANN and MARGARET A. KENNARD

Department of Psychiatry, New York University College of Medicine

Interpretation of the electroencephalogram (EEG) is made at present almost entirely by visual estimate of wave forms, frequencies, phase, and amplitude relationships which are obtained from different areas of the cerebral cortex. Much of the interpretation of these records must always be done in this manner, for as an X-ray diagnosis, for example, there is no substitute for the skilled and experienced interpreter. But it is obvious that any additional objective measure of significant factors in these records would be of value not only in interpreting individual records but in comparing standards from the different laboratories now being established in many countries.

With this in mind, there have been a number of attempts to develop automatic or semiautomatic analyzers of these tracings. Frequency analyses, both manual (*1–4*) and automatic,

[1] Aided by a grant from the New York Foundation.

are at present available, but these can be used only as research tools because of the complexity of instrumentation and assemblage of data. The present interphase analyzer, in contrast, requires little additional time or training and affords a measure of a single variable which is practically significant.

The apparatus has been designed in such a manner that it can be connected between the pre- and power amplifiers of a 6-channel Grass electroencephalograph without alteration of standard equipment. Switches are provided to connect the analyzer with the EEG, or to disconnect it, at will. When disconnected, the usual 6-channel EEG record is obtained. When connected, 4 of the 6 channels continue to record the usual EEG while the remaining channels produce the phase analysis.

In the analyzer, the push-pull alternating potentials obtained from the preamplifiers are converted to single-ended operation (Fig. 1). This is accomplished by inverting half of

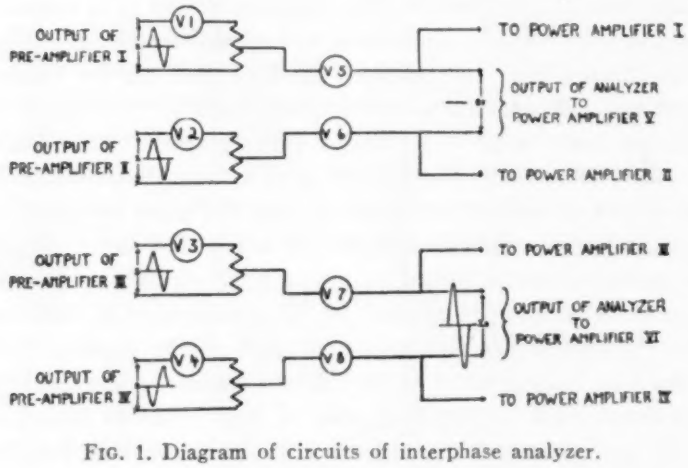

FIG. 1. Diagram of circuits of interphase analyzer.

the varying push-pull voltage of each of the preamplifiers of the first 4 channels. Both uninverted and inverted halves of the signal of each channel are then connected to ½-megohm resistors, and the single-ended output is taken from the junction of these. The single-ended output of channels 1 and 2 is fed to the grids of tubes V5 and V6, respectively; that of channels 3 and 4, to tubes V7 and V8, respectively. It will be noted that tubes V5 and V6 as well as V7 and V8 are operating in push-pull again. The output of the push-pull circuit V5 and V6 is then the analyzer voltage which is recorded as the instantaneous voltage differences between the activity of channel 1 and that of channel 2 on channel 5. Similarly, the output of the circuit V7 and V8 is the analyzed record of the simultaneous potential differences between the activity of channel 3 and that of channel 4, and appears on the record of channel 6.

The operation of the instrument is best shown by records of the two possible extremes. Such records are always made as part of the calibration procedure during analysis of all EEG's. These limiting conditions are demonstrated in Fig. 1. Channels 1 through 4 are here recording from a single cortical area. Channel 5 shows the resultant analysis of the in-phase activity between channels 1 and 2. Since all activity is simultaneously in-phase, the output is zero, or a straight line on the record. Channel 6 depicts the analysis of the activity of channels 3 and 4 shown in complete phase opposition. The output here is double the amplitude of the original activity. This is true only if activity of both areas is approximately of the same amplitude. If a marked difference in amplitude exists, it must be taken into account by considering the base line to be the difference in amplitude of the two areas under analysis rather than zero. In the analyzer, frequency and phase differences are detected only by means of phase discrimination, the amount of frequency or phase discrepancy being expressed as phase shift. Hence, focal differences either in phase or frequency become significant.

Practically, it is well known that phase relationships between cortical areas are important. However, using the ordinary visual interpretation, their detection is limited to low frequencies within the range of alpha activity or less, since above that level the resolving power of the eye, the speed of recording, and the accuracy of pen alignment is too limited for detection of phase reversals. In these higher frequency ranges, the analyzer can show phase shifts or reversals which are significant. Furthermore, in many instances in which the EEG suggests a focus which is indefinite and in which phase reversals may be present only temporarily, clear delineation by use of the analyzer is often possible.

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Effective Copying of Kymographic Records

O. S. GIBBS

1544–46 Netherwood Avenue, Memphis, Tennessee

The copying of kymographic or other smoked-paper records has many intrinsic difficulties well known to workers therewith. Direct copying can be done, using the record as the negative, and with such papers as Insurance Bromide grade RR (Eastman) fairly good results are obtainable. However, these as a general rule are not satisfactory for publication purposes.

Introduction during the war of new types of waterproof papers has entirely changed this situation, and copies of all records may be made with the greatest possible ease and success. The writer has experimented with several types of material including Resisto (Eastman) and some ex-Army material, but by far the best so far encountered is Grade 4 QUIK.[1] This material behaves like a medium chloride paper and is exceedingly tolerant of exposure variation, which is around 30 seconds for an ordinary tracing using 5 daylight bulbs dimmed to about half strength. Development is with ordinary hydroquinone 1;;1 developer and takes about 1–2 minutes. Fixing with fresh material may be complete within 3 minutes, and washing in free flowing water in 10 minutes. As the base is quite waterproof, drying is very fast, and not much curling occurs.

In order to facilitate printing and eliminate a great many unavoidable variations in smoking and varnishing, it is well to brush the back of the record, over the parts required for copying, with a mixture of light petroleum. This can best be done visually over the safelight in the printing box. Providing there is no actual excess of oil, no difficulties are occasioned thereby,

[1] Obtainable from Grant Photo Products, 401 4th Avenue, New York.

and the paper can be placed immediately over the record and printed. One assistant and I completed over 80 such prints in 3½–4 hours. The records had been previously sorted, but the oiling was done at the time of printing. The oil, being volatile, slowly disappears and in no way harms the records.

Fig. 1 shows an ordinary blood pressure and salivary secretion record obtained in this manner. Comparing this latter

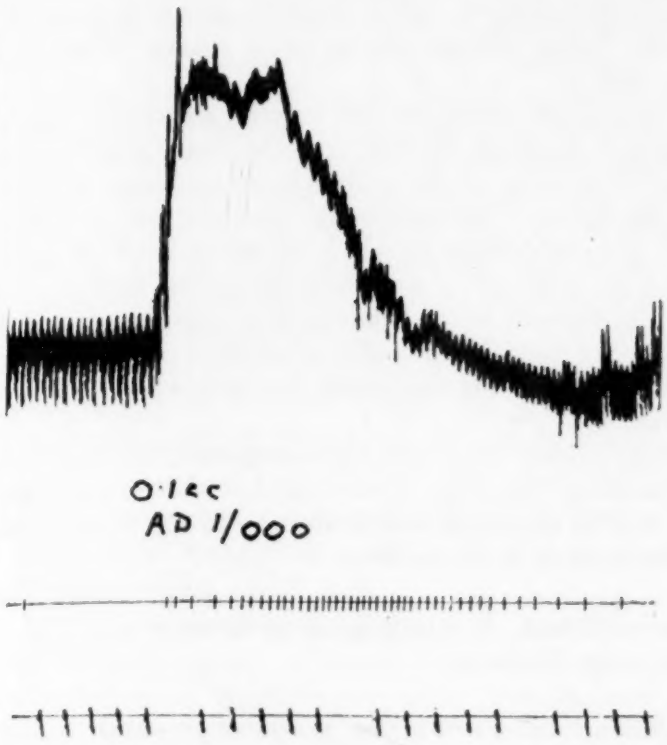

FIG. 1

with the bottom time tracing, one may see the irregularities of a poorly working signal faithfully reproduced. This is not a picked tracing and is varnished with a particularly poor

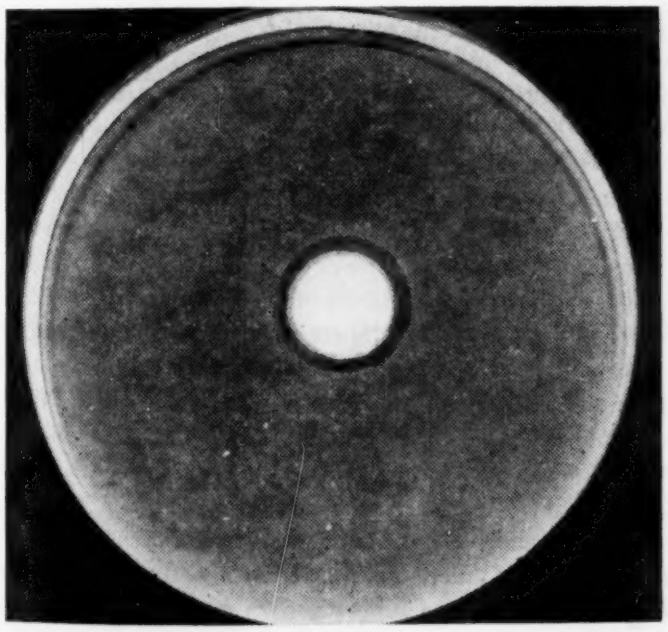

FIG. 2

wartime material which would render ordinary photographic reproduction difficult.

The same paper serves well to make direct prints of culture plates for permanent record of antiseptic tests. An example of this is shown in Fig. 2, which depicts a 48-hour *Staphylococcus aureus* culture. For this purpose the lid must be removed. Under an ordinary 100-watt lamp at a distance of 2 feet a 2-second exposure is about right. Such records do not have the clarity of photographic reproduction because of irregularities in the culture dishes, but they are quite satisfactory for ring measurements and permanent records of such labile results.

An Adaptable Three-dimensional Graph Model

JAMES W. BROWN

Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture, Beltsville, Maryland

Three-dimensional graphs offer a convenient visual means of evaluating the effects of two variable factors upon a third factor—for example, the effect of different temperature and moisture levels on the rate of inactivation of 2,4-D in soil. With the aid of such a graph maximum and minimum combined effects, contours, and trends are readily apparent.

Construction of this type of graph is generally time consuming. However, when once constructed, the graph described (Fig. 1) can be easily readjusted to present data obtained

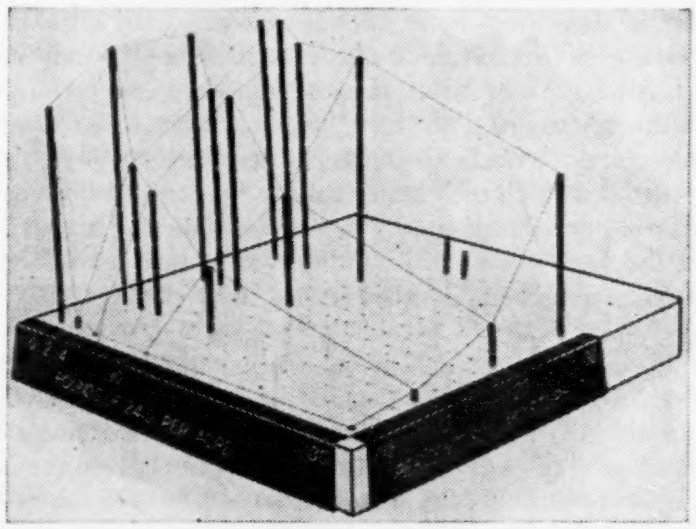

FIG. 1

from various problems involving three different factors; or, where more than three factors are concerned, it can be made to show relations of combinations of these.

This apparatus lends itself readily to photographic reproduction so that the data can be permanently recorded.

A board, 17 x 17 x ⅝ inches was marked off in square inches. Holes ¼ inch in diameter were drilled at the line intersections. The base was then painted with Kodak brushing lacquer No. 4. The upright pegs were made from ¼-inch doweling cut in lengths of ½, 1½, 2½,. . . 10½ inches as required; and, in this case, they were graduated in inches by pasting strips of black gummed paper around them. The upper ends of the series of pegs were connected by white cotton thread as shown in the figure. Clips to hold the thread were attached to the pegs with the aid of a gun-type stapler.

Data can be presented on this model in semilog form. A base graduated in logarithms would, of course, be necessary for log-log presentation.

Differences required for significance at the 5 and 1 per cent levels can be shown by pegs at one side of the graph.

Book Reviews

Introduction to atomic physics. (Rev. ed.) Henry Semat. New York: Rinehart, 1946. Pp. xi + 412. (Illustrated.) $4.50.

The increased need for training and understanding in atomic and nuclear physics brought about by the spectacular advances in "atomic energy" makes most timely this revised and enlarged edition of *Introduction to atomic physics*. The title refers to "atomic" not solely in the classical sense but in the modern sense in which the nucleus plays a major role.

The book is obviously written by a careful teacher with both the instructor's and the student's viewpoints in mind. The typography and illustrations are attractive, and there is at least one figure for every two pages of text. As a concise, one-semester, college-level introduction to the world of atomic physics, the book is admirable. It quickly leads the student into the realm of the infinitesimally small by an exposition that is attractive, yet surprisingly thorough. As a survey, the book is comprehensive and lends itself to self-study for the scientist in other fields. In each chapter there are problems which illustrate well the magnitudes of various factors involved and references to excellent texts which contain more subject detail. There is a nice balance between development of theory and illustration by experiment. Calculus is used in the theory only occasionally and then at an elementary level. When a mathematical proof is long, it is removed to the appendices.

The text does not unfold in the customary historical manner, which too often confuses the student, but breaks naturally into three general parts by category. "The Extranuclear Structure of the Atom" and "The Nucleus" are preceded by a section on "Foundations of Atomic Physics," which occupies roughly half the book. This section is logically divided into an essential short résumé of classical electricity and magnetism, which is immediately put to practical use to interpret both the wave and particle manifestations of atomic structure. These follow under the three headings: "Elementary Charged Particles," "Electromagnetic Radiation," and "Waves and Particles." Alpha particles, cathode rays, electrons, ions, and even the mass spectrograph and stable isotopes are discussed under the first heading; photoelectric effect, Zeeman effect, and X-rays are embraced under the second; and the duality concept of waves and particles, electron diffraction, Heisenberg's uncertainty principle, and Schrödinger's equation are masterfully treated in the third.

The hydrogen atom is discussed from the viewpoints of both quantum and wave mechanics, in the portion devoted to the extranuclear structure, and is followed by sections on atomic spectra and electron distribution.

Part III, "The Nucleus," consists of chapters on "Natural Radioactivity," "Disintegration of Nuclei," and "Nuclear Energy." This part has been brought up to date to include concise but adequate treatment of nuclear reactions produced by various bombarding particles, radioisotope production and properties, nuclear transitions, fission, photofission, transuranic elements, chain reactions, and even an atomic bomb! Future editions will no doubt contain an expanded Part III.

There is the unorthodox but effective separation of Rabi's magnetic resonance method from the Stern-Gerlach experiment. The theory of the betatron is not juxtaposed with that of the cyclotron and electrostatic generator but is included as a new and different type of X-ray source in the discussion on X-rays. The latter was done not without recognition of the development of the betatron as a means of nuclear and cosmic-ray study, but probably to introduce early in the book an application of electromagnetic principles in a useful modern device.

This reviewer found both the arrangement and the content stimulating. The book is recommended without reservation for starting the college-level student on his way to a technical understanding of the atomic age.

PAUL C. AEBERSOLD

Isotopes Branch, U. S. Atomic Energy Commission, Oak Ridge, Tennessee

Explosion and combustion processes in gases. Wilhelm Jost. (Trans. by Huber O. Croft.) New York-London: McGraw-Hill, 1946. Pp. xv + 621. (Illustrated.) $7.50.

For those unable to read German, the translation of this important work should serve a useful purpose. Those at home with German, or moderately so, will derive a distinct advantage from the German edition in an appreciation of the spirit behind the original documentation—something that the reviewer considers lacking in the translation. While the translator performed a faithful and creditable work, the worker in the field of flame and combustion must be disturbed by the awkwardness of expressions, which make reading and sometimes comprehension difficult. For example, the following sentence occurs on page 22: "According to whether the surface in question introduces or breaks off reaction chains especially vigorously, the surface will begin to be effective at particularly low or only at very high temperatures." If one substitutes the accustomed word usage of the field of chain reactions—"initiates" for "introduces," "terminates" for "breaks off," and "efficiently" for "especially vigorously"—the sentence then becomes meaningful. The usual term, "Faraday dark space," is translated as "Faraday dark section."

We again find incorrect translation in the definition of the auto-ignition process (p. 1). The translator has written: "Auto-ignition processes include all those phenomena based upon the fact that, in an explosive mixture heated to an infinitesimal degree, the rate of reaction as the result of the infinitesimal change increases beyond all bounds." Jost says (correctly): "Auto-ignition processes are all phenomena based on the principle that in an explosive mixture heated to onset of barely noticeable reaction, the reaction velocity ultimately increases beyond all limits as a consequence of this primary small chemical change."

The reviewer does not know the extent of trivial errors in the book, but a brief random search revealed the following: the date "1935" instead of "1939" (p. vii); "methane yields" instead of "methanol yields" and "O_3" instead of "O_2" (p. 415); and "$C_{14}H_{66}$" instead of "$C_{34}H_{66}$" and "substance" instead of "substances" (Table 12, p. 581).

The author index appears incomplete, but mathematical equations seem to be reproduced faithfully and well, and the arrangement and typography are excellent. A conversion table from c.g.s. to f.p.s. has been added by the translator.

Apparently, in his zeal to couple Jost's book to the much-publicized and fetching term, "jet propulsion," the publisher has misstated on the cover page that the book is "A translation of the classic German work on jet propulsion." This, Jost's book is not—the term "jet propulsion" does not even appear.

Despite the above, this translation should fill a needed gap for those who, for one reason or another, have been deprived of reading Jost's book in the German.

BERNARD LEWIS

Explosives Division, Bureau of Mines,
U. S. Department of the Interior

Basic mathematics for technical courses. Clarence E. Tuites. New York: Prentice-Hall, 1946. Pp. xiv + 309. $5.00.

This book covers the material usually treated in trigonometry and precollege algebra courses. The approach is standard but is in some respects better suited to the needs of the technical man than most existing texts. The author is to be commended on the representative choice of problems from all fields of engineering, the inclusion of Kirchhoff's laws in his discussion of linear equations, as well as the use of j for $\sqrt{-1}$ instead of i, so easily confused with electric current. On the other hand, the viewpoint is not rigorous. The author tends to talk around his subject instead of saying exactly what he means. By the addition of four or five pages the presentation could be made mathematically correct without detracting from the clarity of the subject.

Needless to say, the average elementary textbook on mathematics is in some respects a hundred years behind the times, each author copying over the errors of the preceding. Thus, Tuites introduces the "axioms" of equality as "self-evident truths," a notion long outmoded but still persisting in the textbook literature. The treatment of numbers is incomplete, although more of the logic is included than in many comparable works.

It is assumed here that the reader is familiar with the operations of multiplication, division, addition, and subtraction. Many excellent short cuts for performing these operations in special cases are given, such as adjoining two zeros and dividing by 4 instead of multiplying by 25. Although these short cuts are in common use, they are seldom listed for the student. Significant figures, the checking of computations, and other arithmetical topics are brilliantly explained.

The book begins with a discussion of the slide rule, so that if the reader does not reach the chapter on logarithms, he will at least know about this application. From arithmetic the reader is led to polynomials, radicals, and imaginary numbers. The latter are explained geometrically through rotations, a popular viewpoint. With this background the reader is introduced to the solution of algebraic equations. Since this subject is not carried very far, the extremely useful process of synthetic division is not attained. The book closes with some chapters on plane trigonometry which leave little to be desired. Five-place tables of logarithms and trigonometric functions are given at the end.

Written by an instructor at the Rochester Institute of Technology, this book was intended for industrial and extension schools, as well as for technical institutes and junior colleges. The book is particularly well suited to the man who has forgotten his algebra and trigonometry or who has never studied these subjects and wishes a clear, elementary, and practical presentation. Except for questions of rigor, which would normally not bother the average reader, this work is admirably adapted to the purpose for which it was written.

RUFUS OLDENBURGER

Illinois Institute of Technology, Chicago

Physical chemistry. H. Hunt. New York: Thomas Y. Crowell, 1947. Pp. x + 610. (Illustrated.) $4.75.

In the preface to this text, the author states, in part: "Since one cannot be sure what the future chemist will need to know, all the fundamental topics of physical chemistry are presented with proper regard to their relative importance." It would be difficult indeed to find a topic of interest to physical chemistry which is not at least mentioned. Many topics are given a more thorough and precise treatment than is customary in the usual text for beginners in physical chemistry. Among these topics are: kinetic properties of gases, crystal structure of solids, atomic spectra and structure, chemical kinetics, and theory of electrolytic solutions. The large number of tables of data, the many illustrations, and numerous problems add much to the value of the book.

Specific objections can be made to details of treatment of some of these topics, but in general a fairly successful compromise is made between a completely rigorous and a descriptive treatment. The compromise would be much more successful if a more orderly presentation had been made. It was the announced plan of the author to make each chapter as nearly as possible an independent unit. As a result of this plan, concepts are frequently introduced which are not explained until several paragraphs or even chapters later. This requires considerable search on the part of the student and instructor to find the necessary background for a given deduction. This search might in itself be a good thing in the case of a large reference work, but in this text it leads to excessive repetition of concepts and equations. Preferably, the material of a text should be presented in a unified, logical order. The extent to which a given topic is to be pursued could be left to the instructor, as it must be in any case.

The treatment of elementary principles of thermodynamics is confusing and is the part of the text most open to criticism. Many formulas which are true only for the ideal gas are given without this qualification. The inexperienced student will no doubt believe that the relations have general validity. An example of this can be seen on page 90, especially the latter part of equation (3–2), and several unnumbered relations near by. Several equations in this section are in error or are misprinted. The statement of the second law as $\Delta F = \Delta H - T\Delta S$ (p. 98) may not be helpful to the student, since the entropy, aside from a complicated "definition" on page 93, is not discussed and explained until page 112. The function F is

defined and extensively used, but the essential reason for its introduction is nowhere clearly stated, or could not be found by this reviewer. An orderly treatment of thermodynamic principles might well have formed the first chapter, since an extensive discussion of fugacity is given in the present first chapter.

This text may prove stimulating to small classes of special students under the direction of experienced instructors. In the case of large, heterogeneous classes, as are usually found today it will be of considerably less value.

A. B. F. DUNCAN
Department of Chemistry, University of Rochester

The electronic theory of acids and bases. W. F. Luder and Saverio Zuffanti. New York: John Wiley; London: Chapman & Hall, 1946. Pp. ix + 165. (Illustrated.) $3.00.

This little book, dedicated to G. N. Lewis and read in manuscript form by him before his death, has as its principal thesis the propagation of Lewis' electronic theory of acids and bases. In reading the book one has the feeling that here are two ardent disciples of Lewis who are attempting enthusiastically to spread the true gospel. The 13 chapters are entitled: "Historical Background," "Atomic Orbitals and Valence," "The Electronic Theory of Acids and Bases," "Electrophilic and Electrodotic Reagents," "Acidic and Basic Radicals," "Neutralization," "Titration With Indicators," "Displacement," "Catalysis," "Acid Catalysis," "Base Catalysis," "Alkoxides as Catalysts," and "Conclusion."

By way of illustrating the points they wish to make, the authors have collected together and organized in a readable fashion a large amount of interesting and instructive data. Every chemist could benefit by reading this book because of its many suggestive and provocative postulates and theories. However, unless one reads critically, he may conclude that the electronic theory of acids and bases constitutes the whole and complete story of the phenomena considered. To test the accuracy of the theories and data presented, the reviewer made a detailed study of the authors' description of one base-catalyzed reaction, the aldol condensation of acetaldehyde (p. 138) (this being picked more or less at random from the large number in the book). Here we are told that the catalysts used are bases such as acetates, carbonates, pyridine, and amines, and the reference given is to a paper by the noted Oxford physical chemist, R. P. Bell. In that paper, however, Bell states specifically that the aldol condensation of acetaldehyde is catalyzed only by the hydroxide ion, and that acetate ions cannot catalyze the reaction by themselves but only to the extent that hydroxide ions are produced by hydrolysis. Luder and Zuffanti give no hint that any other mechanism of aldol condensation is possible, yet at least one other slightly different mechanism which fits all the facts can be imagined. Nor do they indicate that at low hydroxide-ion concentration the simple mechanism is no longer valid.

One is struck by the practically complete lack of quantitative data, graphs, and equations. No rate equations, for example, are given, despite the fact that nearly one-third of the book is devoted to the subject of catalysis. Nevertheless, read critically and with mental reservations, the book has much to contribute to the chemical thought of the day.

MALCOLM DOLE
Department of Chemistry, Northwestern University

Analytic geometry and calculus. John F. Randolph and Mark Kac. New York: Macmillan, 1946. Pp. ix + 642. (Illustrated.) $4.75.

The authors of this text write in a vigorous, clear, and simple manner, dropping many unnecessary terms, yet pointing out many pertinent facts which are often neglected.

Although the material in the calculus is essentially traditional, the authors break new trails in handling many details. Maclaurin is not mentioned in connection with Taylor's theorem. The inverse trigonometric functions are defined as one-valued (with no reference to principal values). The sections on analytic geometry are reduced to a minimum, but are carefully and effectively handled. The device of leaving some difficult details to more extensive works and of putting much more in small print leaves a consecutive course in large print devoted chiefly to technique and to clarification of the essentials. A more than usual emphasis is placed upon discontinuities and limited domains. Many of the proofs are particularly gratifying in their rigor and simplicity. Duhamel and all his works are ignored. Gauss's rules for approximation are developed, but no section discusses significant figures or Newton's method. The figures are in most cases excellent.

The only serious criticism of items that have been included concerns the authors' random use of "f" (in isolation). This sometimes refers to the whole correspondence, sometimes to the value assumed by the dependent variable. The omissions are not easily condoned. In clearing out the rubbish, the authors have retained subnormals and subtangents, yet nothing is said concerning hyperbolic functions, simple harmonic motion, the catenary, convergence of series, angular velocity and acceleration, orthogonal curves, vectors, or such engineering notions as deflection of a beam or modulus of a spring.

Despite the many unexpectedly good features of this text, the course remains pretty thin in applied content. For most physicists and engineers, one might demand a more nourishing fare.

ALBERT A. BENNETT
Department of Mathematics, Brown University

Organic reactions. (Vol. III.) Roger Adams. (Ed.-in-Chief.) New York: John Wiley; London: Chapman & Hall, 1946. Pp. viii + 460. (Illustrated.) $5.00.

This volume carries out the plan of the first two volumes of the series, also edited by Roger Adams with the collaboration of Werner E. Bachmann, Louis F. Fieser, John R. Johnson, and H. R. Snyder. It comprises critical discussion of 9 classes of organic reactions. As stated in the preface to the series, "The subjects are presented from the preparative viewpoint, and particular attention is given to limitations, interfering influences, effects of structure, and the selection of experimental techniques. Each chapter includes several detailed procedures illustrating the significant modifications of the method. . . . When all known examples of the reaction are not mentioned in the text, tables are given to list compounds which have been prepared by or subjected to the reaction."

The chapters of the volume are as follows: 1, "The Alkylation of Aromatic Compounds by the Friedel-Crafts Method," by Charles C. Price; 2, "The Willgerodt Reaction," Marvin

Carmack and M. A. Spielman; 3, "Preparation of Ketenes and Ketene Dimers," W. E. Hanford and John C. Sauer; 4, "Direct Sulfonation of Aromatic Hydrocarbons and Their Halogen Derivatives," C. M. Suter and Arthur W. Weston; 5, "Azlactones," H. E. Carter; 6, "Substitution and Addition Reactions of Thiocyanogen," John L. Wood; 7, "The Hofmann Reaction," Everett S. Wallis and John F. Lane; 8, "The Schmidt Reaction," Hans Wolff; and 9, "The Curtius Reaction," Peter A. S. Smith.

Of particular interest to the reviewer was the chapter on the Willgerodt reaction and the Kindler variation of it. This is the reaction by which a ketone is converted to an amide by the reaction of ammonium polysulfide. It is an unusual reaction in the sense that a ketone such as ethyl phenylketone is converted into β-phenylpropionamide by this procedure, and there is considerable speculation as to the mechanism.

The chapter on "Azlactones" contains a large amount of interesting material which is not commonly discussed.

The material given in the chapter on the Schmidt reaction (reaction of hydrazoic acid and carbonyl compounds in the presence of strong mineral acid) will be found useful to those interested in the synthesis of amines, amides, and their derivatives.

J. G. Aston

Department of Chemistry, The Pennsylvania State College

Smith's college chemistry. (6th ed.) William F. Ehret. New York-London: D. Appleton-Century, 1946. Pp. xii + 677. (Illustrated.) $4.75.

This revision is written under new authorship and from a fresh viewpoint, which sets it apart from the other editions; the author deserves more credit than the title would imply.

The text content is quite comprehensive and up to date. The sequence of topics is classical and seems to be well integrated, even though several times the author appears to be grasping for a connecting link. The method of presentation and quality of material indicates, however, that this edition is intended for the better student who has already had a course in chemistry in high school.

A feature well worth mentioning is the use of boldface print for new terms, for definitions, and for general emphasis.

Such topics as atomic structure, equilibria, and ionization seem to be adequately treated. A chapter on "Energy and Chemical Change" and another on "Electromotive Chemistry and Voltaic Cells" are well placed.

In general, however, the figures and pictures are very poorly executed, as demonstrated in Figs. 7, 11, 13, and 14 (which would not be recognized as a balance arm). This fact and the lack of sufficient pictorial material to break up the large pages give the book an unfortunately dull and drab effect. This is particularly true of the early chapters, which are already quite dull because of the subject matter contained in them.

Among items that can be listed as unfortunate are the use of the phrases "throw light on" and "sealed up the mouth" (p. 7); the statement, "Two substances can come together in two different ways" (p. 8); the definition of chemical property as a chemical reaction (p. 8); the verb in the sentence "The negative radicals stem from chlorine atoms . . ." (p. 71); and the use of double dots to show ratios (p. 111). Also, the periodic table (p. 178) contains elements 93, 94, 95, and 96 in positions not justified by their chemical properties.

A. B. Garrett

Department of Chemistry, The Ohio State University

Practical physiological chemistry. (12th ed.) P. B. Hawk, B. L. Oser, and W. H. Summerson. Philadelphia: Blakiston, 1947. Pp. xiv + 1323. (Illustrated.) $10.00.

The 12th edition of this work appears on the 40th anniversary of the publication of the first under the signature of the senior author. The several revisions form a running commentary on the tremendous growth of physiological chemistry in this first half of the century. Inasmuch as 10 years have elapsed since the appearance of the 11th edition, revision for the 12th is considerably greater than for most of the earlier issues. The coverage of subjects is broader than ever, including tissues, foods, enzyme action, digestion, absorption, putrefaction, excretion, respiration, metabolism, hormones, vitamins, and antibiotics. It is up to date enough to include brief mention of the synthesis of penicillin G and production of isotopes by controlled nuclear fission. The table of atomic weights includes neptunium; however, virginium and alabamine likewise are there.

As in previous editions, laboratory procedures are given in sufficient detail to be followed easily. Presumably the authors are aware that their text is frequently used as a reference work as well as a teaching text. For these reasons the sharpening of certain minor points would be desirable. For example, the first experiments on dialysis include no recommendation for testing the membranes for leaks (p. 9); and perhaps it should be emphasized (p. 516) that, even with the improved Brown procedure, uric acid cannot be added to blood and satisfactorily recovered. In spite of these very minor criticisms, this revision will be welcomed by its friends and will undoubtedly win many new ones.

The text is handsomely bound, and the printing is unusually clean.

Benton B. Westfall

Boyds, Maryland

Advances in carbohydrate chemistry. (Vol. 2.) W. W. Pigman and M. L. Wolfrom. (Eds.) New York: Academic Press, 1946. Pp. xiv + 323. $6.60.

The second volume of this series is again a valuable contribution to the field of carbohydrate chemistry. In contrast to reviews published during the war years, it is, as the preface states, international in scope: four reviews are presented by English authors, one by a French author, one by Canadian reviewers, and, in addition, there are four contributions by Americans.

Melezitose and turanose are the subjects discussed by Hudson. Evidence is presented to prove the structure of both the disaccharide and the trisaccharide. A thorough discussion of the anhydro sugars, presented by Peat, includes a comprehensive table of the properties of the anhydro sugars and their derivatives which should prove very valuable. Analogues of ascorbic acid is the topic discussed by F. Smith. Various syntheses are given, and the correlation between physiological activity and structure is presented. Lespieau describes the synthesis of hexitols and pentitols, giving rather detailed

procedures for the preparation of the alcohols and some of their derivatives. The interrelation of carbohydrate and fat metabolism is reviewed by Deuel and Morehouse, who not only present evidence for the conversion of carbohydrate to fat and the alleged reverse transformation but also include a rather complete discussion of ketolysis versus antiketogenesis. In the review of mucopolysaccharides and mucoproteins, by Stacy, an excellent classification of the various complexes is presented. Evans and Hibbert, in their review of bacterial polysaccharides, emphasize the complexity of the problems, although indicating that definite progress is being made in this difficult field. The chemistry of the pectic materials is reviewed by Hirst and Jones, while McDonald discusses polyfructosans and difructose anhydrides. Many properties of these sugars and their derivatives are listed. The final review, contributed by Haskins, concerns cellulose ethers of industrial interest.

The book is especially valuable because the authors are actively working in the fields concerned. Each reviewer gives an historical background in the subject discussed. Such information is, of course, available in the literature, but a concise summary is always to be desired. The volume is well edited and contains a wealth of material essential to anyone interested in the field of carbohydrate chemistry.

JOSEPH S. BUTTS
Department of Chemistry, Oregon State College

Advances in enzymology and related subjects of biochemistry. (Vol. VI.) F. F. Nord. (Ed.) New York: Interscience Publishers, 1946. Pp. x + 563. (Illustrated.) $6.50.

Like its predecessors, this volume contains critical documented summaries of the advances in the borderland between physical and biological chemistry, physiology and microbiology.

In "The Bacterial Amino Acid Decarboxylases," E. F. Gale discusses the conditions necessary for their formation, the cell-free preparation of them, their properties, and their resolution into apo- and coenzymes. Pyridoxal phosphate appears to act as coenzyme for the four known decarboxylases; in acid solution it may have a protective function. M. G. Sevag reviews "Enzyme Problems in Relation to Chemotherapy, 'Adaptation,' Mutations, Resistance, and Immunity." "Adaptive" enzymes do not exist; unfavorable metabolic environment merely reduces the activity of enzymes already present. The biochemical changes in increased resistance to unfavorable conditions appear genetically to be regressive processes; the development of new strains implies acquisition, by a recessive cell, of genetic factors from cells of a higher order. D. W. Wooley, writing on "Biological Antagonisms Between Structurally Related Compounds," states that these can in most cases be explained by the displacement hypothesis.

"Adenosine Triphosphate Properties of Myosin" is the contribution of V. A. Engelhardt. These are such that all of the ATP in muscle could be split by myosin in one second. Conditions responsible for the inaccessibility of ATP are considered, and a tentative scheme for the sequence of events is proposed. In "States of Altered Metabolism in Diseases of Muscle," by C. L. Hoagland, are included atrophy, hypertrophy, and diseases of voluntary muscle in man. "Acetyl Phosphate," discussed by F. Lipmann, plays a role in the metabolism of bacteria and of animal tissues; the chemical and energetic relations are surveyed. In "Microbial Assimilations" C. E. Clifton includes those of carbon, carbon dioxide, and nitrogen, as well as the influence of poisons and of genetic factors. W. G. Frankenburg writes on "Chemical Changes in the Harvested Tobacco Leaf." In the curing process these changes affect the static, nitrogen, and dynamic groups in the leaf and are the result of the action of the leaf enzymes. "The Actions of the Amylases," by R. H. Hopkins, and "The Amylases of Wheat and Their Significance in Milling and Baking Technology," by W. F. Geddes, survey the properties of the amylases, their occurrence and assay, and their significance in breadmaking. K. C. D. Hickman and P. L. Harris, in "Topocopherol Interrelationships," suggest a general shortage in the American diet, as well as many synergistic relations which warrant greater consideration, but it is difficult to disentangle fact from theory and vitamin from covitamin.

An author index (22 pp.) and a subject index (13 pp.) add to the usefulness of the book.

H. A. MATTILL
Department of Biochemistry, State University of Iowa

Vitamins and hormones: advances in research and applications. (Vol. IV.) Robert S. Harris and Kenneth V. Thimann. (Eds.) New York: Academic Press, 1946. Pp. xvii + 406. (Illustrated.) $6.80.

This volume will undoubtedly enjoy the same wide acceptance and use as have the preceding volumes. It is not a review in the usual sense, since only a limited number of subjects are treated. However, each subject is covered comprehensively, aiming to give both detail and a broad understanding of the subject. Cross indexing and extensive bibliographies increase its value as a reference book.

Many of the subjects treated are quite timely because of widespread interest in their practical applications. The section on "The Newer Hematopoietic Factors of the Vitamin B Complex" is especially timely because of the recent demonstration that pteroylglutamic acid (folic acid, *L. casei* factor, etc.) has antianemic activity in man. It is unfortunate that this review was written before many of the clinical results became available. However, the authors were able to append a few paragraphs summarizing these recent developments.

The section on "Thyroactive Iodinated Proteins" is also quite timely, since the use of these substances to increase yields of milk and eggs is receiving considerable attention in agricultural circles. Details as to methods of preparation, properties, and methods of assay are given.

To those who have been confused by the many apparently conflicting results the section on "Nutrition and Resistance to Infection" should be of help. The author has reviewed the available evidence in a critical fashion and has indicated certain basic considerations important to a general understanding of the problem.

The volume includes a unique article on "Manifestations of Nutritional Deficiency in Infants." The author has apparently had unusual opportunities to study this subject and has collected information which should be useful to both nutritionists and pediatricians.

Two chapters deal with vitamin-hormone interrelationships. "The Effect of B Vitamins on the Endocrinologic Aspects of Reproduction" deals with experimental aspects of this complex and relatively undeveloped subject. The second of these chapters, "Nutritional Therapy of Endocrine Disturbances," attempts to apply certain laboratory observations to man. While there seems to be little doubt that there is a definite relationship between nutritional status and hormonal balance, it is difficult to evaluate the clinical claims. Some workers have been unable to confirm the widespread usefulness of this technic, as indicated in the review.

The chapter on "The Thyroid and Diabetes" presents a review of the available experimental data and discusses the practical aspects of the interactions of these glands.

Another section deals with "The Protein Anabolic Effects of Steroid Hormones." It seems well established that these substances do exert an effect on nitrogen retention and protein synthesis. Whether these interesting observations will have practical usefulness, except in certain endocrine states, seems to merit further investigation.

The final chapter describes "Methods of Bioassay of Animal Hormones" and deals especially with the anterior pituitary and adrenal cortical substances. For those attempting such determinations this chapter should prove most useful.

In general, the presentations are well chosen and carefully written, and most are critically evaluated. The defects are minor and more than compensated by the wealth of information presented.

JAMES M. HUNDLEY

Division of Physiology,
National Institute of Health, Bethesda, Maryland

Medical biochemistry. (2nd ed.) Mark R. Everett. New York-London: Paul B. Hoeber, 1946. Pp. xii + 767. $7.00.

While the author's main objective in writing the first edition was to provide a readable text for medical students, the second edition "was undertaken to provide accurate modern information for students and others who regard the book as a convenient reference volume." This change in objective was effected without substantial change in the arrangement, scope, or nature of the contents.

The subject matter is arranged in an interesting, although somewhat unusual, manner. The first two chapters are devoted to acid-base relations, colloids, enzymes, and energy metabolism. Following the subject of digestion, the chemistry, metabolism, and pathology of the lipides, carbohydrates, proteins, inorganic substances, vitamins, and hormones are treated in order. The author has covered the material in these chapters in an adequate manner without making the volume encyclopedic. He has incorporated in the new edition most of the recent developments in biochemistry, such as the antibiotics, Rh factor, dicumarol, phosphorylation, etc., and has expanded such topics as anoxia, plasma proteins, vitamins, muscle diseases, hypertensive factors, and ketogenesis.

The usual historical approach characteristic of most writers in this field has intentionally been eliminated, and the author has "avoided unnecessary speculations and argumentative considerations." However, he has placed at the end of each chapter a well-arranged bibliography of selected modern reviews. Although the book contains many tables and some diagrams, it is lacking in illustrations and color plates. Generally, each topic is preceded by an interesting literary quotation. A comprehensive index and a separate index to the tables and diagrams are included.

Students and workers interested in the various aspects of biochemistry will find this book a helpful addition to their library.

EMIL G. SCHMIDT

School of Medicine,
University of Maryland, Baltimore

Penicillin in syphilis. Joseph Earle Moore. Springfield, Ill.: Charles C. Thomas, 1947. Pp. x + 319. (Illustrated.) $5.00.

This supplement to *The modern treatment of syphilis* which has appeared in monographic form deals with the use of penicillin, either alone or combined with other therapeutic agents, in the treatment of the various manifestations of syphilis. To those who possess or will possess the parent volume this small book will prove a welcome and valuable addition. Except for an interesting discussion of reinfection and superinfection, there is no new knowledge in this monograph concerning other forms of treatment or the fundamental biology of syphilis.

The first eight chapters are devoted to a discussion of the pharmacology, toxicity, and mechanism of the action of penicillin and to other basic considerations. The majority of these chapters, while containing much that is important and fundamental, have little worth in the practical management of the patient. To the specialist, and to the experimentalist, they are of great and long-lasting value.

The remaining chapters deal with the use of penicillin in the management of syphilis in the human being, and one small chapter is devoted to treatment with streptomycin. The material is taken largely from the reports of the many civilian clinics and laboratories and installations of the Army, Navy, and Public Health Service cooperating in the organized nationwide study of penicillin in the treatment of syphilis.

As Moore admits, much of the material presented may be outdated by the time of publication, particularly as this material applies to the treatment of the patient who has syphilis. The basic considerations remain the same, but dosage schedules are being revised constantly. It seems unfortunate, then, that only three pages are devoted to the present-day treatment of early syphilis while many more pages are used to discuss obsolete dosage schedules which, while of experimental and historical interest, are of little value in the practical management of the patient.

The knowledge to date indicates that penicillin is of value in the treatment of certain of the late forms of syphilis. Beyond that, little may be said. For this reason, the chapters on latent and cardiovascular syphilis are justifiably short. Those chapters on penicillin in neurosyphilis, prenatal syphilis, and syphilis in pregnancy are incomplete but contain many worth-while practical aspects of treatment and observation. The true status of treatment of syphilis with penicillin and concrete deductions from its use cannot be made for several or more years, as Moore has recognized in the introduction.

The bibliography is complete up to October 1946. Many important articles since that date have appeared in the more prominent medical journals, and to these the readers of this volume should have easy access.

The typography and format of the volume are superior. The figures and tables admirably illustrate the statements of the author.

All in all, the purposes of this monograph seem to have been accomplished. Undoubtedly, it will be replaced in a few years by its combination with a new edition of *The treatment of syphilis* with greater and more lasting conclusions. For the future it will have historical interest and value. New chemotherapeutic agents undoubtedly will be developed, and reference to this volume will be of great aid in determining the approach necessary for their proper appraisal.

ROBERT R. KIERLAND

Mayo Clinic, Rochester, Minnesota

Biochemistry of cancer. Jesse P. Greenstein. New York: Academic Press, 1947. Pp. viii + 389. (Illustrated.) $7.80.

Research on cancer has been relatively slow in development and, as an experimental science, began only at the beginning of the present century. The long tradition of pure morphologic study had meantime fastened itself with throttling grip on the investigation of neoplastic disease, and cancer research itself in effect was, until recently, suffering from an intellectual cancer. It is one of the strange vagaries of science that chemistry, instead of being introduced early, has been the latest of the disciplines to enter cancer research.

There have been several previous treatises on the chemistry of cancer, but all have consisted of undigested collections of facts and errors, assembled magpie fashion, containing some good data but with so much trivial dross as to make them valueless. Also, as the author aptly states: "More chemists than one have blundered in oncology, not so often on the basis of poor oncology as of bad chemistry. For some odd reason, cancer research has been the graveyard of many a scientific reputation."

The present volume, then, is unique in that it assembles for the first time quantitative chemical data which are discussed in a critical manner. It is more than the biochemistry of cancer; it includes a great deal of information on the ancillary sciences—the physiology, genetics, and even taxonomy of the neoplastic state.

After an orienting introduction the volume is divided roughly into three parts which deal, respectively, with chemical aspects of the induction, control, and properties of tumors. Since the author is one of the leading enzymologists, the catalytic factors naturally receive greatest emphasis, but this is felicitous in that the enzymes of cancers are, in the thoughts of many workers, agents of very high importance. Dr. Greenstein's forte has been the study of the spectrum of the protein catalysts in normal, neoplastic, and germane states. As a generalization, he has arrived at the conclusion that tumors tend to converge, enzymatically, to a common type of tissue and to resemble one another rather more than the tissues of origin.

This volume represents a vast amount of scholarship and will be indispensable reading for all workers in cancer research, whether savant or tyro. It is destined, no doubt, to become dog eared in scores of laboratories.

The style of the author is characterized by elegance and simplicity, and his writing is occasionally enlivened by nice touches of pointed humor and stimulating speculation. The only criticism of this work deals with the modesty of the author, which is so great that he has not included himself in the author index.

Dr. Greenstein is well qualified to write this volume, being head biochemist at the National Cancer Institute. His important contributions to the quantitative chemistry of proteins are well known. His studies and this book are in the best tradition of the U. S. Public Health Service, of which he is a distinguished member.

CHARLES HUGGINS

Department of Surgery, University of Chicago

Parenteral alimentation in surgery with special reference to proteins and amino acids. Robert Elman. New York-London: Paul B. Hoeber, 1947. Pp. xx + 284. (Illustrated.) $4.50.

Dr. Elman has brought forth a timely and distinguished book. Although written primarily for the surgeon, it should be read by all workers, clinical as well as laboratory, whose work touches the healing art, human or animal. The book deals with the administration, to patients unable to assimilate food by the gastroenteric route, of the basic units of the six substances which are concerned with the maintenance of corporal integrity, namely, water, minerals, vitamins, carbohydrates, fats, and proteins. For the surgeon, preoccupied with the exacting demands of his strenuous professional life, this volume is both a bringer of gifts from the basic disciplines of biochemistry, nutrition, and physiology and a manual at once comprehensive and practical. Dr. Elman has delved into at least six different fields, going over the knowledge which had been built up by research workers over decades, and distilled from them this compact volume. Typifying the ideal modern surgeon, he had had a wide research training and experience prior to entering the specialty of surgery and has been a prodigious worker in one of the sectors of this field, the new and important sector of intravenous amino acid alimentation. He has made important and basic contributions in this sector and, indeed, should be credited with bringing it into practical clinical use. He is, therefore, eminently qualified to write such a book, and it is doubtful whether, in the hands of any other author, it could have been so lucidly and effectively written.

The book is well organized, skillfully integrated, written in a highly readable style, and presented in a well-balanced manner. It is brief without sacrificing scientific exactitude and scholarship. As is to be expected, the best chapters are those in the field of the author's major research competence—the protein field; but the chapter on water and electrolyte needs is also excellent. That on the history of intravenous therapy is interesting and illuminating, and the extensive field of vitamin therapy, which would appall others, has been skillfully packed into 11 pithy pages. The chapter on the practical program of intravenous alimentation, which climaxes the book, is practicable and highly instructive. The cases used as illustrations are well chosen, as are also the charts and figures, which are clear, easy to grasp, and well reproduced. Furthermore, the book is well documented, covering some 450 papers by over 500 authors. The extensive bibliography, culled with such painstaking care from a field which must number publications by the thousands, should prove exceedingly valuable to the more serious student.

Dr. Elman must be congratulated on rendering the clinical fields a threefold service: first, in bringing clarity, order, and organization into a confused field; second, in giving a demonstration, to use the words given in the preface of the book, on "how advances in surgery frequently have emerged in fields entirely outside surgery itself," and third, in exemplifying in his own professional life how this can be effectively brought about.

Co Tui

477 First Avenue, New York City

The human ear in anatomical transparencies. Stephen L. Polyak, Gladys McHugh, and Delbert K. Judd. Elmsford, N. Y.: Sonotone Corporation, 1946. (New York: T. H. McKenna, distributors.) Pp. 136. (Illustrated.) $10.50.

This work is unique in that it is a joint product of an anatomist, a medical artist, and an otolaryngologist; it is novel in its technique of transparent illustrations which, for the most part, are excellently performed; and it is ambitious in the attempt to analyze the ear from the standpoints of ontogenesis, phylogenesis, morphology, and function and to present the material in a form useful to interested laymen, scholars of speech, scientists, and medical specialists.

The book is in two parts. The first, which is general in scope, consists of five chapters. Chapter 1 deals very briefly with the chief functions of the ear, hearing and equilibrium, and their phylogenesis. Chapter 2 outlines very simply the constituent parts of the ear. Between Chapters 2 and 3 is a set of transparencies consisting of 12 beautifully colored drawings of serial dissections of the right side of the head which, when superimposed on each other, give a composite picture of the dissected head showing considerable depth. Chapter 3, is essentially an anatomical atlas of the head, designed to show the topographical relationship of the ear to the rest of the structures. It is fortified with 14 colored plates of dissections at various levels. The text, besides presenting anatomical description, stresses functional and topographical relationships. Chapter 4 presents a careful anatomical and functional description of the larynx and is well illustrated in color with views of 11 dissections, 4 laryngoscopic views, and other diagrammatic aspects. The text is partly descriptive but is written largely from the standpoint of the student of speech. Chapter 5 is a lengthy account of the anatomy and function of the external ear, and the abundant illustrations depict both the ontogenetic and phylogenetic development.

Part II consists of Chapters 6, 7, and 8, which present a more detailed anatomical and functional description of the middle and internal ear. Chapter 6, like Chapter 3, is a topographical descriptive atlas, but includes only the more limited area of the ear. Whereas the illustrations in Chapter 3 are life sized, those in Chapter 6 are magnified 3 ×. Just preceding this chapter there is a group of 8 transparencies depicting serial dissections of the region of the internal and middle ear at a magnification of 3 ×.

The colored drawings, both in the transparencies and in Chapter 6, are very well done and the views well chosen. The text is a conventional account showing nothing new.

Chapter 7 deals with the microscopic anatomy of the internal ear. The test here is also a conventional account. The illustrations taken, for the most part, largely from classical textbook figures, are augmented by drawings from sections of the ear of *Macaca rhesus* and from Golgi preparations showing nerves and nerve terminations from various animals.

The final chapter is concerned with the functions of the middle ear and internal ear. Although various theories regarding the function of the middle ear are cited, the question is left open. However, in the case of the cochlea the authors lean very strongly to Helmholtz's theory.

The book is very readable and, with the numerous unique but splendid drawings, should be of interest to the layman as well as to the scientist.

T. H. Bast

Department of Anatomy, The University of Wisconsin

Ophthalmology in the war years. (Vol. 1.) Meyer Wiener. (Ed.) Chicago: Year Book Publishers, 1946. Pp. x + 1166. $13.50.

Meyer Wiener, together with an imposing number of associate editors, has produced a volume which reviews all obtainable literature in ophthalmology from 1940 to 1943. Such a book was requested by the Subcommittee on Ophthalmology of the National Research Council. It was intended to make available to physicians, who were in the service as well as at home, the great wealth of ophthalmic literature which appeared in the first few years of the war. Over 8,000 articles have been abstracted, and an exhaustive bibliography has been compiled.

The text is printed in large type and on good paper. The basic sciences, clinical and scientific investigations, therapeutics, and surgery have been included. The book has greatest value as a reference volume. Although few sections can be read as a whole with full grasp of the tremendous amount of information digested in the numerous paragraphs, specific knowledge, when sought by topic, may be found concisely and accurately reported. The many pages that have been condensed to a single book enable one to conserve energy and time when searching for information of that three-year period. Those engaged in research will find this volume of tremendous help.

The editor has attempted to assign subjects and sections to appropriately qualified authorities for review and, since the associate editors are also deep students of ophthalmology and men of well-known reputation, one is assured that topics have received expert attention. Some sections have been reviewed in a more interesting fashion than others. Whereas some chapters are simply a succession of paragraphs representing well-reported articles, they do not contain good commentary and evaluation, which the average reader seeks. Other are masterpieces, and one feels that the subject matter has been weighed, sifted, organized, and presented so that nothing is left to be desired.

Noticeably lacking are illustrations and photographs. These would have greatly enhanced the value of the book, not alone to the ophthalmologist interested in writing and research but also to the busy clinical eye physician.

Dr. Wiener and his co-editors deserve an expression of gratitude for the great task which they have undertaken and and completed during such a trying period.

Benjamin Sachs

520 Beacon Street, Boston

Adjustment to physical handicap and illness: a survey of the social psychology of physique and disability. Roger G. Barker, *et al.* New York: Social Science Research Council, 1946. Pp. xi + 372. (Illustrated.) $2.00.

The purpose of this investigation is well stated in the following paragraph from the introductory chapter: "There is a widespread assumption among laymen and social scientists that physique in its social-psychological aspects is of great importance in the motivation of the individual. Among clinical psychologists and psychiatrists there is a great superstructure of theory based upon case studies and clinical experience which assumes that important sources of personal maladjustment lie in the somatopsychological situation of the individual. It is the purpose of this publication to bring together the widely scattered knowledge bearing upon this problem. We propose to raise this question: What is known of the social and psychological significance of physique and in terms of what concepts can the known facts be described and explained?"

The authors do not concern themselves with all the relations between physique and behavior but confine their survey to what is designated as the "somatopsychological problem," *i.e.* the problem of the purely psychological and social significance of physique, or how physique determines behavior. Only those variations in physique considered relevant to the somatopsychological problem are discussed. The criteria of relevancy formulated by the authors are three: (1) The physique must instigate behavior which in turn requires behavioral adjustments not directly induced by the particular physical characteristic in question; (2) the physique must be perceived by the person or others as being of significance for his life career; or (3) the physique must be perceived by the person or others as having social significance in the particular culture.

From a long list of physical variations believed to have somatopsychological significance the authors have excluded age, race, sex, speech defects, and leprosy. This leaves cosmetic defect, muscular strength, motor ability, visual impairments, auditory impairments, tuberculosis, heart disease, diabetes, rheumatism, cancer, orthopedic disability, and acute illness. The authors then undertake to review and interpret the available literature on those topics which represent the more important practical problems as well as the main types of variation in physique, namely, normal variations in physique, orthopedic impairments, tuberculosis, impaired hearing, and acute illness.

Each of the principal chapters attempts to draw out from general analysis those hypotheses and conclusions that appear to be warranted by the available research. Each chapter concludes with one or more "research summaries" of the most important studies bearing upon certain topics considered in the general discussion. One special chapter discusses the employment of the disabled. This is primarily a review of the more general literature on the problem and supplements the discussions of employment presented in the more specialized studies considered in the preceding chapters.

It is a little surprising that only incidental attention is given to visual deficiencies. Seriously limited vision would seem to meet one or more of the authors' criteria of relevancy and to be among the "more important practical problems."

Following the main body of the report are 52 pages of bibliography, divided into two sections. The first includes studies considered in developing the analyses and interpretations of the special topics included in the book itself; the second, bibliographies on physical variations not specifically treated, e.g. visual disability, cardiac disability, diabetes, cosmetic defect, rheumatism, and cancer.

It is obviously impossible to state a brief general conclusion to which this volume leads. It is reasonably clear, however, that the authors have demonstrated the truth of a statement made in the preface, namely, that "the state of our knowledge of these matters (*i.e.* the somatopsychological significance of variations in physique) is little above the level of folklore in many respects . . . ," and that a very large superstructure of practical action in such areas as occupational therapy, industrial employment policies, hospital organization and administration, industrial accident legislation, and vocational rehabilitation has been based upon this limited knowledge. The authors also show that promising and valid techniques are available for the study of problems of great practical and theoretical importance in this field. Both for its bringing together in one place a considerable mass of material and for its suggestive and thought-provoking analysis and interpretation the volume will be extremely useful to any individual or group proposing either to undertake additional studies of the significance of physical variations or to formulate policies and plans for the practical affairs of daily life.

W. B. FEATHERSTONE

Teachers College, Columbia University

A psychology of growth. Bert I. Beverly. New York: McGraw-Hill, 1946. Pp. 200. $2.50.

When a physician writes a book on psychology, he is likely to get into difficulties similar to those which would probably be encountered by a psychologist attempting to write a book on medicine. There are many evidences of this in *A psychology of growth.*

The portion of the book dealing with the practical aspects of behavior problems is accurate and valuable, although in this reviewer's opinion far too much emphasis is placed on the pathological conditions. It is, of course, understandable why that emphasis would appear in a book by a physician written for nurses. But the psychology of the author is neither accurate nor up to date and in many cases is inconsistent. At times he writes like a Watsonian behaviorist, at times as a Freudian, and throughout his discussion displays an unusually strong prejudice toward the influences of heredity.

While in general he gives helpful suggestions for dealing with behavior problems, at times he fails to do so. For example, we are told: "In addition to acquiring food, sucking provides an emotional satisfaction. That is the reason why all babies suck their thumbs and they should be allowed to do so." Almost no suggestions are given, however, concerning means of providing such emotional satisfactions that the infant will not suck his thumb, and the question of diet as one cause of the action and the malformation of teeth as one result are apparently not considered important. Again, the reader is warned that there should be skillful supervisors on the playground because "homosexual practices which cause great distress in later life can start with childhood play." However, in the following sentence is the statement: "The supervisor who finds children engaging in sex experiments should not become perturbed because such a reaction can create dis-

turbances in the minds of the youngsters." No suggestion whatever is made as to what the supervisor should do if he discovers homosexual practices, and the reader is left with the implication that a person should not be disturbed concerning a practice which may cause great distress in later life.

As has been suggested above, there are many errors of fact when the writing touches directly the field of psychology. The statement that "two-year-olds are able to distinguish black from white but do not distinguish between colors" indicates a clear lack of information of researches in child psychology. Similarly, the statement in more than one place in the book that abstract thinking does not begin to develop before the age of 12 is clearly out of line with the evidence. Indeed, Beverly misquotes the Stanford revision of the Binet scale in supporting his statement. It is true that on the tests definitions of abstract words are called for at age 12, but the doctor did not look back to see that on Form M there is also such a test at age 10 and on Form L at age 11. Of course, there is all sorts of evidence to show that abstract thinking begins to develop very much earlier than these ages. On the subject of intelligence and intelligence tests there are also many errors. An outstanding example is the statement that the 1908 Binet-Simon tests "consisted of six tests for each year from three to eighteen." This instrument consisted of 5 tests for each year from 3 to 10, a 12-year test, a 15-year test, and a very imperfectly standardized adult test. Still again, very few psychologists working in the field of school subjects will be happy at the statement that "spelling, reading, and writing difficulties are usually innate." There is evidence that this is not the case. Neither does the best evidence agree that "because of their rapid growth adolescents fatigue easily and have poor motor coordination."

Indeed, there are so many inaccurate or misleading statements that it would seem distinctly unwise to recommend this book, despite its many good features, as one which could be used in any class in psychology.

D. A. WORCESTER
Teachers College, The University of Nebraska

Human factors in air transport design. Ross A. McFarland. New York: McGraw-Hill, 1946. Pp. xix + 670. (Illustrated.) $6.00.

The main thesis of this book, according to the author, is to demonstrate the importance and need for studying human factors which should be considered in the design and operation of air transports. With remarkable attention to detail and with the aid of numerous tables, graphs, charts, diagrams, and pictures, Dr. McFarland has presented a large portion of the work which has already been done in this field. The presentation is not confined to a discussion of the medical, physiological, and psychological studies which have been made, but also includes detailed discussions of design and engineering features relevant to the human factors involved.

The subject matter has been divided into 10 parts, each with its own chapter, as follows: (1) "High-Altitude Operation and Pressurized Cabins," (2) "The Control of Ventilation, Temperature, and Humidity," (3) "The Control of Insects and Air-borne Diseases," (4) "Carbon Monoxide and Other Noxious Gases," (5) "The Control of Noise in the Cabins of Aircraft," (6) "The Control of Vibration in Air Transport Planes," (7) "Acceleration, Motion, and Flight Performance," (8) "The Cockpit and Control Cabin of Air Transports," (9) "Passenger Accommodations," and (10) "The Prevention of Aircraft Accidents."

This is a book written by an expert in one field (aviation psychology and physiology) for the use of experts in related fields (aeronautical engineering and airline operation). It has an extremely broad scope, and it would be difficult to name many relevant problems which are not included. Yet, because he was writing for engineers, the author evidently felt obliged to present the material in as concrete and specific form as possible. As a result, many research findings assume a more definitive and authoritative form than would be granted them, perhaps, by other biological scientists. Dr. McFarland is careful to point out where inadequacies of this sort exist. Even where generalizations are not wise, the data have been presented in minute detail—a form of presentation which overemphasizes the significance of the findings.

In spite of this practice there is no doubt concerning the value of the book for anyone, including the biological scientist, who is working in this new field. For aeronautical designers and airline operators it should become required reading. As the author points out, "until aircraft can be flown completely automatically, the human element should be considered as an integral component. A truly functional design will be achieved only after it is thoroughly realized that the crewman (and passenger) is as much a part of the plane as any structural or mechanical feature." Too often the problems arising from human factors in design and operation have been settled by "a majority vote of those sitting in judgment" without recourse to experimentation or even systematic observation. Dr. McFarland has offered ample evidence that when research by competent investigators replaces solutions based on opinion, the reward in terms of human safety, efficiency, and comfort is great.

A. C. WILLIAMS, JR.
University of Illinois, Urbana

Indians before Columbus: twenty thousand years of North American history revealed by archaeology. Paul S. Martin, George I. Quimby, and Donald Collier. Chicago: Univ. Chicago Press, 1947. Pp. xxiii + 582. (Illustrated.) $6.00.

Modern archaeology in the United States may be said to have begun about 1912 with Nelson's percentage stratigraphy in the Galisteo Basin, New Mexico. Since that date the authors of *Indians before Columbus* are the first to tackle the job of systematizing the net gains of North American research archaeology over this 35-year period.

At the outset let the reviewer go on record as being in favor of this book. It totals up as a good one. It has no competitors, and in this circumstance it has all the advantages and hazards of being a "first." The book is a sound stocktaking of what professional archaeology has to offer as basic data for America north of Mexico. On the whole, the material presented is as up to date as it was possible to make it.

Indians before Columbus is written, say the authors, for the interested layman and the beginning student and is not intended for a general professional reference. In spite of this, it is a useful book for every archaeologist to own. The three short introductory chapters, which are eminently successful,

explain to the uninitiated what archaeology is, what is known concerning the origins of the American Indian, and the truth behind a number of common popular fallacies concerning the American Indian. Chapters 4 through 9 take up, in order, the arts and industries by which the Indians are chiefly known to the archaeologist: stone, copper, bone and shell, pottery, basketry and cloth, and trade and commerce. A clear picture of the technologies involved, the degree of mastery of each, and integration and significance to a preindustrial economy is presented to the reader. The actual archaeology deals first with the earliest Indian inhabitants of North America as represented by the Folsom, Yuma, Sandia, and Cochise finds. An attempt is made to demonstrate possible intermediate horizons between these early lithic cultures and pottery-agricultural periods. A treatment of the later periods follows a fourfold areal division into (1) Southwest, (2) eastern North America, (3) Pacific slope, and (4) Far North, or Eskimo. Each of these major areas is again divided into several regions.

Criticisms are of two kinds: (1) of specific points of fact in sequential-distributional information or interpretation, and (2) of presentation and broader interpretation. Specifically, in the discussion of the Hohokam culture of the Southwest the chronology used follows Gladwin's earlier, rather than his more recent, estimates, but there is no reference to this point. In discussing the southeastern "Death Cult," Krieger's recent but radically different interpretation is not taken into consideration. In Georgia there is no substantial evidence for burial mounds in the Deptford period. The chronological position given for the Florida Crystal River culture is highly debatable. In southern Louisiana the Troyville period is put in the Burial Mound rather than the Temple Mound stage. This tends to obscure the important fact that the temple mound-plaza arrangement complex had its first appearance in the Southeast at this relatively early date, notwithstanding its association in the Troyville period with Marksville-Hopewell style pottery.

On a more general level, the book loses a great deal of its force as an introductory popular book by its failure to follow through on interpretations of cultural process. If the book is for the general reader, and if the book is to hew to the line of one set of historical interpretations—both avowed purposes of the authors—then certainly it should go further beyond the time-space cataloguing of cultural data than it has. For example, at several places in the discussion of the eastern United States we are taken right up to the point of what should be the pay-off reward for all this archaeological grubbing, only to be anticlimactically dropped. In speaking of the decline in craft arts in the late prehistoric periods in the Northeast, the authors make this interesting statement but go no further: "Thus there is a decline in terms of material remains, but this decline probably is not real. Certainly the improvements in the economy (agriculture), the possible social changes, and the probable lack of the need for tools and industries of the past mark a type of climax or florescence that cannot be grasped by archaeological techniques" (p. 258). But what does this technical and aesthetic decline, just preceding the historic horizon and also remarked upon again and again in several other subareas of the East, imply in social terms? With a minimum of inference from ethnography the lacunae of archaeology can be filled to show the late prehistoric period as the time of rising political confederacies and war alliances in the Northeast. These must, inevitably, have been the result of mounting population pressures correlated with the improved agricultural production so characteristic of the late prehistoric era all through the East. With the necessitated shift to organized war patterns the old religious emphasis of the East, much of it centering around the burial cult and its associated craft goods, disappeared. At least, this is one explanation, for which there is considerable supporting evidence, that the average reader might hopefully expect in a general book on the rise and growth of American Indian cultures.

GORDON R. WILLEY

Bureau of American Ethnology,
Smithsonian Institution, Washington, D. C.

Trinidad village. Melville J. and Frances S. Herskovits. New York: Alfred A. Knopf, 1947. Pp. viii + 351. (Illustrated.) $4.75.

This book is a worthy contribution to two phases, among others, of the study of human culture: It represents a workmanlike addition to the slowly accumulating literature of "modern," as opposed to "primitive," ethnology; and it demonstrates the intricate interweaving of African and European traits which is the result of the acculturation process in so many Negro groups of the New World.

The Trinidad village in question is Toco, at the extreme northeastern end of the island, and the population is almost entirely negroid. The community is rather isolated in terms of effective contacts with outside centers of cultural diffusion, and as a separate entity it is relatively new, having been settled for the most part within the past 50 years by people coming from other parts of Trinidad and Tobago. In these respects Toco offers a situation in which the immediate historical factors, if not "controlled," are at least known and assessable, which is an advantage in analyzing the dynamics of custom integration and social organization, while it also exhibits to a degree the cultural homogeneity of custom and physical type which is characteristic of peasant and folk cultures generally.

The field work was undertaken in 1939 as part of a long-term project with which the Herskovits name has been associated for some 20 years, namely, the study of the various adaptions in the New World of Negroes whose ancestors were transplanted from Africa in slavery. The differential stripping, retention, and reinterpretations of African cultural elements in the American setting is the center of interest in this book. As the reworking of native African culture is better understood, contributions to the general theory of cultural change are offered.

Using the concept of "cultural focus," the authors demonstrate that most of the formal aspects of African culture, including the institutional structure of social organization and religion, have disappeared in Toco. Yet, many of the basic orientations, particularly in family arrangements, religious groups such as the Shouters, witchcraft, the persistent power of ancestral spirits, etc., come directly from the African systems. In Toco they are in many cases so embedded in a matrix containing elements from other sources as to be unidentifiable to the casual observer. Nevertheless, such identification and understanding is a prerequisite to scientific analysis and prediction of the actual behavior of the people. The problem of Toco has its parallels not only in numerous other Negro communities of the Western Hemisphere, but also among the

millions of persons in Latin America who practice a mixed culture, derived from indigenous Indian, colonial Iberian, and modern European sources.

The semipopular style presumably required of a commercially published report makes for relatively smooth reading, at the expense, however, of the omission of details of method and data which would be of interest to specialists. The latter type of material will doubtless appear in more technical publications.

JOHN GILLIN

University of North Carolina, Chapel Hill

Fossil vertebrates from western North America and Mexico. E. L. Furlong, *et al.* (Contributions to Paleontology, Publ. 551.) Washington, D. C.: Carnegie Institution of Washington, 1946. Pp. iv + 195. (Illustrated.) $2.50, paper; $3.00, cloth.

The latest volume of Contributions to Paleontology covers the years 1943–46 and includes eight articles on fossil fishes, birds, and mammals.

Three papers by Lore Rose David, entitled "Use of Fossil Fish Scales in Micropaleontology," "Some Typical Upper Eogene Fish Scales from California," and "Upper Cretaceous Fish Remains From the Western Border of the San Joaquin Valley, California," demonstrate the use of fossil fish scales in stratigraphic correlation and in paleoecology. This author states that it is nearly always possible to recognize families, genera, and often species on the basis of differences in scale sculpture—a point that might be disputed by some ichthyologists. The recognition of characines, for instance, in marine Upper Cretaceous deposits, is of considerable importance if the scale identifications are certain.

"A Review of the Pleistocene Birds of Fossil Lake, Oregon," by Hildegarde Howard, is a well-documented account of all the known bird remains from this rather famous Upper Pleistocene locality. Although there is a general resemblance between the avifauna of this deposit and that now living about the fresh-water lakes of Oregon and California, interesting examples of subspecific differences are present which indicate subdivisions of a chronocline. Unexpected members of the fauna include a flamingo and a jaeger.

The history of the badgers in North America has been greatly clarified by E. Raymond Hall in a contribution entitled "A New Genus of American Pliocene Badger, With Remarks on the Relations of Badgers of the Northern Hemisphere." The new genus, *Pliotaxidea*, is based on skull fragments originally referred to *Taxidea* and a recently discovered skull from Oregon, all of Pliocene age. It is now apparent that the Asiatic and American badgers have been separated since possibly the Upper Miocene, with *Pliotaxidea* close to the *Taxidea* line and *Parataxidea* of the Asiatic Pliocene close to the ancestral stock of *Meles*. There is no evidence of intercontinental migration within this subfamily subsequent to the early Pliocene.

To the nonspecialist, at least, the taxonomy of the North American fossil antilocaprids presents a rather confusing picture. This is due partly to the difficulty of differentiating true taxonomic characters from those associated with age and sex, and this problem is evident in a paper by E. L. Furlong, "The Pleistocene Antelope *Stockeros conklingi* From San Josecito Cave, Mexico." The exact distinction between *Tetrameryx* and *Stockoceros* is not completely clarified, although the author states that "*Stockoceros* is at least subgenerically distinct from *Tetrameryx*." A second contribution by the same author deals with the "Generic Identification of the Pleistocene Antelope From Rancho La Brea." This antilocaprid is removed from the genus *Capromeryx* and is assigned to the new Pleistocene genus *Breameryx* on the basis of apparently distinguishing dental and skull characters. It would appear that the antilocaprids offer a very fertile field for quantitative taxonomic study.

"A Miocene Mammalian Fauna From Beatty Buttes, Oregon" is described by Robert E. Wallace. The assemblage is probably Upper Miocene (Barstovian) and presumably includes grassland and woodland forms such as *Merychippus* and *Dromomeryx*. It is very similar to that found at two other Upper Miocene localities in Oregon, Sucker Creek and Skull Springs.

BOBB SCHAEFFER

The American Museum of Natural History, New York City

Mammals of eastern Asia. G. H. H. Tate. New York: Macmillan, 1947. Pp. xiv + 366. (Illustrated.) $4.00.

The new volume in the Pacific World Series represents exactly the type of handbook that should have been available to the personnel of the U. S. forces in China during the war, and thus exactly the need the series was designed to meet. Dr. Tate was co-author with J. E. Hill and T. D. Carter of *Mammals of the Pacific world*, which described the mammals of the Pacific and Australasian islands, and the two volumes form much the sort of naturalist's Baedeker for which we may hope there will be a continuing demand. The production of such volumes is one of the duties of naturalists and one of their functions that deserves active support.

In a brief introduction the mammals as a zoological group are presented to the nonzoological reader, some account of their adaptations to the conditions of existence are given, and the use of scientific names is explained. A glossary at the end of the book supplements this chapter.

A second general chapter, which is an essay on the geography of eastern Asia, interestingly sets forth one of the two frames of reference of animal geography, namely, the climatically dominated ecological-vegetational matrix in which animals find their most obvious natural associations of range. The reviewer has elsewhere been occupied at length with the subject of ecological animal geography, and it is gratifying to have this kind of introduction to the systematic account of the mammals.

The systematic account occupies 325 pages of the book. This forms a most accessible account of some of the more strikingly unfamiliar types of mammals. The insectivores include the tree shrews (now commonly placed with the primates), the hedgehogs and some of their primitive relatives, and a wealth of moles and shrews; the bats are extremely varied, including both the fruit-eating and insectivorous suborders and six families; the pangolins, or scaly anteaters, are represented by two types; the flying lemur occurs in the more southern parts of the territory considered; the lemurs are represented by the slow lorises; there is a large variety of monkeys; and the gibbons represent the higher tailless apes. The carnivores range from familiar furbearers in Siberia, belonging to well-known American types, to the remarkable

lesser panda and giant panda (which are apparently related in name only) and the great variety of civets and mongooses, which are quite unfamiliar to American zoologists. The account of the whales is limited to the forms that enter fresh water, including, of course, the peculiar isolated pigmy dolphin of Tung Ting Lake in China. The rabbits and hares are treated as an order distinct from the closely allied rodents proper, and this draws attention to the presence of a variety of montane pikas closely related to those of the western mountains of North America; the rodents proper include such familiar American genera as *Citellus*, *Marmota*, and *Eutamias* and many others, which calls further attention to the zoological resemblances between North America and Asia. The elephant group is represented by the Indian elephant, which ranges eastward to Indo-China; the aquatic coastal dugong, related to the American manatees, forms one of the most distinct of the orders; the list of even-toed ungulates includes tragulids, pigs, wild cattle, goat-antelopes, true antelopes, sheep and goats, and a wealth of deer; and finally, the odd-toed ungulates are represented by the Malay tapir and three types of rhinoceroses.

Any account of the mammals of eastern Asia necessarily leans heavily on the two large volumes on the mammals of China by the late Glover M. Allen. Because of its bulk the latter work is, however, wholly unsuited to field use, and we are fortunate to have Dr. Tate's handbook-sized work. The illustrations are in general excellent. A curious vagary of typography is the capitalization of the most familiar animal group names, such as Bat, Cat, Wolf, etc., together with the common names in general. This is entirely contrary to modern zoological practice, as may be seen by reference to the *Journal of Mammalogy* or Webster's *Dictionary*.

The high price of this book, as well as of the trade edition of the Pacific World Series in general, most unhappily limits the dispersion of these introductions to natural history at the levels where they would be most useful.

KARL P. SCHMIDT

Department of Zoology,
Chicago Natural History Museum

***A review of the North American species of Philanthus, north of Mexico* (*Hymenoptera: Sphecidae*).** R. W. Strandtmann. (Graduate School Studies. Conti. in Zoology and Entomology, No. 7) Columbus: Ohio State Univ. Press, 1946. Pp. 32. (Illustrated.) $2.50.

From a study of 5,500 specimens of these common wasps, Dr. Strandtmann has achieved a taxonomic analysis of the genus within the area selected. The biology, to which no contributions are made, is reviewed in a single page, and no other topics are discussed.

The well-drawn figures, both of the entire wasps and of morphological details, are pleasing. The presentation of distributional data, mostly only by state, is inadequate. From 100 to 1,200 records of each of the 7 most numerous species would have afforded a real basis for an analysis of their zoogeographic affinities and quantitative distribution—the inescapable responsibility of every taxonomist reviewing a group from adequate material.

Counting "*hirticulus*" as the male of *bicinctus*, there are 22 species, two still known from only one sex. Thirteen of these occur only west of the Mississippi, 3 are ubiquitous, 1 is Floridian, and the remaining 5, with the normal pattern of northern species, inhabit more or less of the Northeast (in one instance, entire East) and prairie and mountain states. Five species are little known, represented by 5 specimens or less, 5 by from 6 to 25, and 5 more by under 100. Of the remaining 7, three of the four represented by over 500 individuals are ubiquitous, and the fourth is widespread over the West.

The species *politus* is divided into 9 subspecies. One occupies the territory east of and including the states bordering the west shore of the Mississippi River. The others are all west of that river and, except for texana, are an aggregate of geographically intermingling forms that seem to present no basis for designating subspecies rather than variants. At least they demand a very much more detailed geographical analysis.

It is a satisfaction to see that the author has disposed of many of the unnecessary trivial names that have cluttered past literature. Yet a little time spent in correspondence could have disclosed the identity of *barbatus* Smith, *crabroniformis* Smith, and *multimaculatus* Cameron. When this has been done, we may anticipate further nomenclatorial changes.

J. C. BRADLEY

Cornell University, Ithaca, New York

Forest soils and forest growth. S. A. Wilde. Waltham, Mass.: Chronica Botanica; New York: G. E. Stechert, 1946. Pp. xx + 241. (Illustrated.) $5.00.

This is the first textbook on the subject of forest soils to appear in the American literature. It represents a scholarly attempt to cover the broad fields of soil science with emphasis on soil as a medium for the growth of forest trees.

In brief, the book might be considered as a monograph on forest soils of cool-humid climates with special emphasis on the management of forest nursery soils of the Lake States. The author's familiarity with the European literature, particularly the Russian, has resulted in the unnecessary use of many foreign terms to describe conditions which have already been acceptably described in the American literature. Examples of this are the use of the terms *melanization* for incorporation of humus, *melanized* horizon for the conventional A_1 horizon, *grood* soils, and *charral* soils.

As in many books, general statements are made which, if important, should be substantiated by quantitative evidence rather than by the citation of references from which they were derived. An example of this can be found on page 65: "In general, soils with a low content of fine soil material, *i.e.* sandy soils, support only trees which have low requirements for moisture and nutrients, such as pines, scrub oaks, white birch, and aspen. On the other hand, soils with a high content of fine particles, *i.e.* loam soils, support trees which have high requirements for moisture and nutrients, such as species of spruce and fir, hard maple, basswood, elm, and white ash (Haig, 1929; Scholz, 1931; Coile, 1935; Hosley, 1936)." The work of at least two of the authorities cited (Haig, 1929, and Coile, 1935) contained little, if anything, to verify the statement as made.

In a number of places the author speaks of "plant food" in the soil. Since plant food is manufactured in the plant through the process of photosynthesis, it is apparent that the author means "plant nutrients" when he speaks of "plant food."

Silvicultural terminology is confused where the term "selective logging" is used as a synonym for the selection system of cutting.

Chapter XII, "Productivity of Forest Soil and Forest Management," is an elementary treatise on what is commonly known as forest regulation and valuation. This information can be found in any textbook on forest management. Entirely lacking is the wealth of information available in the American literature on the relationship between soil properties and site index, rate of growth, and the composition of forest stands.

The last five chapters are concerned with forest nursery soil management. The management practices outlined are particularly adapted to the Lake States region, where they were in the main developed.

T. S. COILE

School of Forestry, Duke University

Forest soils. Harold J. Lutz and Robert F. Chandler, Jr. New York: John Wiley; London: Chapman & Hall, 1946. Pp. xi + 514. (Illustrated.) $5.25.

This book is a very welcome addition to the literature in a relatively new field of applied science in this country. Prior to 1946, material on forest soils was available only in journal articles and foreign language works. American and English texts on soil science are usually written for either the agricultural student or the pedologist (one who studies the soil and its development as a natural phenomenon without regard to its usage). The reader has only to compare the subject matter listed in the indexes of these books with that given in *Forest soils* to appreciate the inadequacy of the former works for foresters.

The thoroughness of coverage is shown by the chapter headings, which include: soil-forming minerals; soil-forming rocks; disintegration and decomposition of minerals and rocks; forest-soil organisms; the organic matter of forest soils; nature and properties of soil colloids; general physical properties of forest soils; the water relations of soils, particularly forest soils; general chemical properties of forest soils; soil formation; forest-soil classification; soil erosion and forest-soil deterioration.

The fundamentals of soil science are stressed, and much of the material is presented in considerable detail with no attempt to simplify for the reader who is not fortified with a scientific background. The treatment of the basic structure of minerals and the mechanics of base exchange, to cite two examples, will be much too technical for many readers. Students in a one-semester course who have not had adequate courses in geology and chemistry will find such portions of the text rather heavy going.

On the other hand, it is a decided advantage to have a book which contains these fundamentals of soil science as they relate to the particular subject—forestry. Recourse to other soils texts will not be necessary unless the student is specializing in a particular phase of the subject. This book will serve as an excellent reference work, and instructors of general soils courses will find it very useful because it approaches the subject from a somewhat different angle than is customary in soils texts.

In one rather specialized branch of the subject—nursery soils—treatment is much too brief to be of use to managers of forest nurseries. The authors undoubtedly preferred to leave that field to others.

Literature citations, which are abundant, are given at the end of each chapter. The text is illustrated with about 33 half tones and numerous well-chosen charts. Several minor changes, such as inclusion of a more up-to-date soil textural class chart than that shown on page 232, and the words "dissolved matter" in the title of Table 5 on page 72, will undoubtedly be made in subsequent editions.

The authors are to be congratulated on the production of this excellent volume, which will take its place along side older, well-known works of European investigators.

HERBERT A. LUNT

Connecticut Agricultural Experiment Station, New Haven

General horticulture. Thomas J. Talbert. Philadelphia: Lea & Febiger, 1946. Pp. 452. (Illustrated.) $4.00.

This book serves producers of horticultural crops and vocational and undergraduate students in schools and colleges with general information on the production and handling practices for a wide range of horticultural crops. It serves primarily the interests of students and growers of tree fruits, small fruits, and nuts in temperate climates. An over-all picture of the entire horticultural industry in the United States is given to show the production areas and relative importance of fruits, nuts, vegetables, flowers, ornamental plantings, and forestry. The reader is also introduced to the more important subtropical and tropical fruits, with pertinent comments on their cultural requirements. The last chapter gives a broad introduction to the practices involved in harvesting, handling, and distributing horticultural crops.

The printed pages are interestingly broken with 129 unusually clear illustrations which have been selected with painstaking care by the author to emphasize important practices and objectives. Most of these engravings are "close-ups," particularly as they are used to illustrate insects and diseases, their injuries, and single-step procedures used in planting, budding, grafting, pruning, and training.

At the close of each of the 21 chapters, selected references of books, bulletins, circulars, and scientific papers are listed to enable the student to give additional time to the study of specific areas in line with his interests.

Separate chapters are given to pome fruits, stone fruits, grapes, strawberries, cane and bush fruits, nut trees, vegetables, beautifying the home grounds, and tropical and subtropical fruits. Chapter I is appropriately devoted to a discussion of the horticultural industry, and the following 10 chapters develop subjects which broadly interrelate with all fruits, such as fruitfulness, pollination, thinning, propagation, soils and sites, planting procedures, soil management, use of fertilizers, pruning, insects and diseases of fruit crops, and their control by spraying and dusting.

Students whose major interest is in fruit growing will find in this book a comprehensive introduction to general horticulture, written in a style that is clear cut, forceful, and most helpful in acquiring a knowledge of sound horticultural practices.

FRANK H. BEACH

Agricultural Extension Service,
The Ohio State University

Since the end of the war a number of books published abroad have been sent to the Science office for review. The following reviews cover some of the most recent of these. Future issues will contain reviews of others as they are received.

Synthetische Methoden der organischen Chemie. W. Theilheimer. Basel-New York: S. Karger, 1946. Pp. viii + 224. Fr. s. 25.

This is a unique reference book in synthetic organic chemistry. It does not contain detailed directions for selected preparations as does *Organic syntheses*, nor does it present exhaustive discussions of single reactions after the manner of *Organic reactions*. Instead, the author endeavors to supply information to the chemist who wishes to achieve a certain result. The basic idea is that few really new reactions have been developed in the past 10 years, but much has been done in the way of improving old ones. There is no quick way of gathering from the literature the hopelessly scattered bits of information relating to classical, as well as little-known, procedures, and the author has done much to supply this deficiency. The present volume is the first of a series and covers the years 1942–44.

The arrangement is new and frankly experimental. Reactions are grouped according to the bond formed. In the symbolism used, the new bond is first indicated; this is followed by a device to show the nature of the reaction, such as addition, rearrangement, substitution, or elimination; anP last is the element involved in the reaction. Thus, CH↑↓O means the formation of a CH bond by replacement of oxygen as in the Clemmensen reduction or hydrogenolysis of an alcohol. Elements follow the Beilstein sequence except that carbon comes last, and the rule of last possible placement is followed. The system appears confusing at first, but with a little use its reasonableness is evident. An edition for American students would be more useful if there were an insert containing an English guide to the system, with a few examples.

There is a generous alphabetical index which lists named reactions as well as types of compounds, whether they appear as starting materials or as end-products. Most reactions can be located through the index without use of the system.

The choice of references is satisfactorily broad in spite of wartime difficulties. Fifty, chosen at random, showed the following distribution: German, 21; American, 13; British, 8; Swiss, 6; others, 2. References to Russian literature are rare.

The book will be helpful to the advanced practitioner, as well as to the beginner who is completely lost when faced with the problem of finding how to carry out a strange reaction. It will be a fertile source of ideas, for the unique arrangement brings reactions together according to the end achieved; consequently, in looking up a procedure the reader will often be surprised to find many new ways to accomplish the same result. As a rule, original papers must be consulted, but most of these are in readily available journals.

M. A. Spielman

Abbott Research Laboratories,
North Chicago, Illinois

Actions of radiations on living cells. D. E. Lea. Cambridge, Engl.: at the Univ. Press; New York: Macmillan, 1946. Pp. xii + 402. (Illustrated.) $4.50

This book deals with a field which is now the center of wide interest from many sides and the object of much work, and which is particularly appealing in that it has appeared to many as a principal pathway for investigating the basic phenomena of life. The book responds to a clear need and should be generally used for study and reference in the field of radiation biology.

The work is aptly described by the author's own words, which appear in the preface: "This book gives an account of certain of the simplest and most fundamental actions of x rays and other ionizing radiations on living cells. It does not survey the whole field but deals chiefly with the mechanism of those actions of radiation which are well enough understood at present to allow a detailed discussion. The relevant physical properties and chemical effects of ionizing radiations are first described, and then the bulk of the book is occupied by the effects of radiations on viruses and on the genes and chromosomes of higher cells. In the concluding chapter the killing of cells by radiation is discussed. Extensive numerical data concerning the dissipation of energy in tissue by various radiations are given. The book is of importance for medical, genetical and biological investigators and for physicists interested in biology."

The reviewer is very sympathetic toward this program and especially appreciates the stress laid on those radiobiological effects which, in a physicist's language, may be termed "elementary." Carrying out this program was an important and laborious task which has been capably and successfully discharged. Quantitative data and literature references are plentiful and well organized. Much space is devoted to a deep and detailed theoretical analysis of the experimental material, including important contributions by the author, some of which are first published here. Therefore, the reading may require considerable effort, but not an unduly great one, as the exposition is remarkably clear.

The reader still unfamiliar with radiobiology should bear in mind that different authors have frequently held widely different opinions on the significance of whatever evidence was available in this field. Even though such divergencies have become less acute in recent years, the book represents Dr. Lea's personal evaluation of the evidence. Accordingly, it is natural that a number of items in the book may not be acceptable to other workers in the field. Thus, for example, this reviewer is not satisfied with the analysis of the recessive lethals in *Drosophila* (pp. 157 ff.). (This matter will be discussed more fully in a future issue of *Science*.)

The author has wisely intended to keep mathematical detail in the background of his theoretical analysis. However, he might well have gone further in this direction by eliminating the quantitative treatment entirely whenever the experimental evidence warrants only broad qualitative statements. This applies, for example, to the analysis of the dominant lethals in *Drosophila* (pp. 164 ff.), in which a specific working model is treated mathematically in great detail; later remarks show awareness of the difficulties met in applying the model, but the over-all impression conveyed to the reader does not seem quite fair. A similar comment may apply to the recurring unusual practice of presenting numerical data with several

significant figures where errors of the order of 10 per cent or more are expected; the insertion of occasional cautioning statements or the possible convenience for numerical work do not seem adequate justifications.

The book contributes to pure as well as to applied physics through very extensive and laborious new calculations on the distribution of radiation energy throughout matter. The author's emphasis on recognizing and analyzing the role played by secondary electrons in this process represents an important advance. As stated in the appendix, the calculations are based on somewhat tentative theoretical assumptions; the eventual influence of these assumptions should be estimated when utilizing the numerical results. The author emphasizes that the energy of photo- and recoil-electrons released by x rays of 10–100 KeV is far from proportional to the x-ray voltage; however, what is important for application is the apportionment of the total x-ray energy among electrons of different energies rather than the apportionment of all the electrons among different energy ranges. The latter is represented by the "mean energy" given in Table 3 of the book. The former is represented by a "weighted mean energy" calculated by giving each electron a "weight" proportional to its energy and is much more closely related to the x-ray voltage.

This book is timely, useful, and important and is recommended for widest circulation; judgment should be exercised, however, in utilizing its content.

The book was completed in the middle of 1944 and became available in England early in 1946. Commercial arrangements prevented its distribution in America until a year later. While the former delay may be charged to war conditions, the latter is highly regrettable.

U. FANO

National Bureau of Standards, Washington, D. C.

Fisica nucleare: dalla pila di Volta alla pila atomica. Plinius Campi and Aldo Rusconi. Milan: Ulrico Hoepli, 1946. Pp. viii + 215. (Illustrated.) Lire 400.

This book covers more ground than the title suggests, since it represents a general survey of the advances of atomic physics from the advent of relativity and the quantum theory to the utilization of nuclear energy.

Chapter 1 includes a condensed account of the structure of matter, ions and electrons, Bohr's atomic model, isotopes, radioactivity, and Planck's quantum hypothesis. Chapter 2, bearing the title "Space, Time, and Causality," gives an elementary account of restricted relativity and of the failure of the principle of causality in quantum physics as expressed by Heisenberg's uncertainty relations. The authors take the occasion for setting forth certain views of their own on the structure of the geometrical continuum. In the reviewer's opinion, whatever the value of such theories may be, discussion of them should be reserved for papers of a technical character and is rather out of place in a book of this type. Chapter 3 is a discussion of the wave properties of material particles as expressed by Schrödinger's equation. Chapter 4 includes an account of radioactivity, artificial disintegration of nuclei, neutrons, and the conditions which determine nuclear stability. Chapter 5 discusses the fission of heavy elements and the utilization of nuclear energy.

The book does not require from the reader more than a general knowledge of elementary physics and mathematics, and the difficult task of popularizing such a vast amount of material is, for the most part, well done. Perhaps the account of the principles of restricted relativity and of quantum mechanics contains some obscurities that might have been avoided. Inaccuracies are few and unimportant.

This book will be particularly useful to readers of a scientific mind, such as chemists, engineers, biologists, etc., who, not being physicists, are not familiar with the more technical accounts of atomic physics and look for an elementary but accurate résumé of the subject.

FRANCO RASETTI

Université Laval, Quebec, Canada

Relaxation methods in theoretical physics. R. V. Southwell. Oxford, Engl.: Clarendon Press, 1946. Pp. vi + 248. (Illustrated.)

This volume, a continuation of the author's earlier monograph on *Relaxation methods in engineering science* (1940), constitutes an extremely important contribution to the literature of applied physics. It shows that almost any boundary-value problem in two dimensions for which one can write down the partial differential equations, and the solution of which one desires badly enough, can be solved by a sort of brute-force, cut-and-try numerical method of attack. It should go far toward dispelling the common idea that there is nothing that can be done about a two-dimensional problem for which an analytical solution has not or cannot be found, except perhaps to look for a physical analogue which is capable of experimental evaluation.

Southwell, in this volume, shows solutions of problems in torsion of solid and hollow cylindrical shafts, magnetic fields in regions containing iron, conformal transformation, capacity of cables, torsion of shafts of circular section but nonuniform diameter, torsion of tores, temperature distribution, shear stress trajectories, oil pressure and temperature distribution in bearings, flow of gas through convergent-divergent nozzles, plastic torsion, percolation, and shapes of free liquid jets.

The versatility of his methods is perhaps best illustrated by these last examples, in which the hydrodynamic equations are solved for free jets whose very shape is unknown at the start, and by H. W. Emmons' successful application (*N. A. C. A. Tech. Notes*, 1944, No. 932; 1946, No. 1003) of these methods to compressible-fluid-flow problems involving shock waves whose positions are initially unknown.

The relaxation procedure starts by replacing the two-dimensional continuum by a 'net' of points and the partial differential equation by a difference equation relating the function value at a given net point to its values at neighboring points. The finer the net, the closer is the approach of the solution of this difference problem on the net to that of the differential problem in the continuum. A trial-function value is estimated at each net point, and in terms of this trial function a 'residual' is computed, this being the amount by which the difference equation fails to be satisfied at each point. The residuals are then 'relaxed' to zero, or worked out to the boundary where they disappear, by successive and repeated changes in the function values at the various points,

chosen at the discretion of the computer in such a way as eventually to make all the residuals vanish. The changes in the various residuals which occur with each change in a function value are made immediately on the net diagram.

Southwell's exposition of the actual computational procedure will be confused for many readers by his insistence on a mechanical analogy in which everything is expressed in terms of 'externally applied loads,' 'string tensions,' 'residual forces,' and the like. For such readers an excellent exposition of the procedure by Emmons (*Quart. appl. Math.*, 1944, **2,** 173) will be useful.

The very power of Southwell's method for handling problems *of whatever type* lies in the fact that *no* definite procedure is given for relaxing the residuals—one is only sure that if by hook or by crook he can get them relaxed, he has solved the problem. It is comfortable and convenient to have a definite procedure for 'relaxing the residuals' such as is given by the 'iteration' procedure, which has seen considerable development in recent years, but only for certain classes of linear, elliptic, partial differential equations. (See G. Shortly, R. Weller, P. Darby, and E. H. Gamble. *J. appl. Phys.*, 1947, **18,** 116, and earlier papers referred to therein. It is pointed out that the 'difference function,' the function 'relaxed' by the iteration procedure of these authors, is closely related to, although not identical with, Southwell's 'residual.') Southwell makes no comment on this procedure, but Emmons does, and it seems appropriate in a review of Southwell's book that some comparison be made for cases where the iteration procedure has been developed. Emmons gives a time comparison in which he says that a certain simple heat-conduction problem on a coarse, 19-point net took him 1.75 hours to solve by the relaxation procedure and the fantastic time of 11 hours "by the method of Shortley and Weller. . .with the use of a calculating machine" (*Trans. A.S.M.E.*, 1943, **65,** 607). The reviewer can only assert that the same problem took him exactly 26 minutes to solve by the last-named method, starting with the same plane trial function as Emmons and without the use of a calculating machine. It is his opinion that the 'iteration' procedure is certainly more convenient and probably more rapid than the 'relaxation' procedure in cases to which it has been applied.

GEORGE SHORTLEY

Mendenhall Laboratory of Physics,
The Ohio State University

Elementary theory of gas turbines and jet propulsion. J. G. Keenan. London: Oxford Univ. Press, 1946. Pp. viii+261. (Illustrated.)

The title of this book is aptly chosen. Volumes could be written on the theory of gas turbines and jet propulsion, but the author has produced a work for the benefit of the average scientific reader. The book will appeal to those who wish to become somewhat acquainted with the theory but who lack the mathematical and thermodynamic background necessary for a more rigorous treatment. With this clientele in mind, the author has avoided the concept of entropy and has based the theory entirely on pressure-volume relations.

By way of introduction the early history of the gas turbine is reviewed. Various components, such as nozzles, combustion chambers, diffusers, etc., are treated individually. The author has effectively arranged the material by first defining such technical terms as are pertinent to the discussion and then applying these concepts to the various types of turbines, compressors, and jets.

The centrifugal and axial-flow compressors are discussed with reference to velocity diagrams, work per stage, losses, efficiency, intercooling, and compressor characteristics. The impulse and reaction turbines are discussed very briefly under similar headings. A chapter is given to heat transfer, since that topic is so intimately associated with gas turbine and jet engine development.

Actual data on performance of this type of equipment are rather meager; however, graphical material is given to show the effect of pressure ratios, reheating, and compounding, and to show the thermodynamic limitations as well as the present stage of development. The various types of jet motors are pictured with their operating cycles shown on pressure-volume axes. The effect of such variables as altitude and air density on performance is given. The last chapter describes installations in which the various forms of turbines and jet motors have found application.

The book is well illustrated and is easily followed. It will fill a present-day need as envisioned by the author.

JOHN C. MILES

Mechanical Engineering Laboratory,
University of Illinois, Urbana

La scissione nucleare dell'uranio: fenomenologia generale. Emidio Prata. Milan: Ulrico Hoepli, 1946. Pp. 160. (Illustrated.) Lire 250.

After a few pages of introduction on nuclear reactions, the author describes the experiments that led to the discovery of fission (Chap. 1). Chapter 2 lists the identified fission products; Chapters 3 and 4, the mass distribution of fission fragments and their ranges in gases. Chapter 5 includes a detailed discussion of the stability of the nucleus against fission, the treatment following essentially the well-known papers of Bohr and Wheeler. Chapter 6 is a discussion of the instantaneous and delayed neutron emission in fission, from both theoretical and experimental standpoints. There follows a discussion of various cross sections for nuclear reactions (Chap. 7) and of the time within which fission occurs (Chap. 8). The conditions for a self-sustaining chain reaction and details on the chain-reacting pile as given in the Smyth report are given in Chapter 9. A complete bibliography of publications on fission from 1934 to 1943, including 325 titles, is given at the end of the volume.

The book constitutes a practically complete résumé of all the work on fission published in scientific periodicals up to 1943, plus a brief summary of additional information released by the Manhattan District after the war. The subject is competently treated, and apparently no essential data available at the time of publication are omitted. The book is evidently intended primarily for the physicist who is not a specialist in nuclear problems and who wishes to become acquainted with the essentials of the fission process. At the same time, it can be used profitably as a reference work by the nuclear physicist himself, the complete bibliography making it particularly valuable in this respect.

FRANCO RASETTI

Université Laval, Quebec, Canada